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66 PAGES

2014



2004 we continue with research on the nature as basic line and sustainability as for better tomorrow of humanity.

1.

Let us continue with eco-remediation activities.

Galileo – College

Israel

ECO REMEDIATION CENTRE

October 2004

Korte, Medosi, Slovenia

Anthology 2 – 2001 - 2014



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Introduction

Eco remediation is complex of sciences, research and business, practical and applied research approach for complex problem solving of environmental degradations.

It is prevention and treatment of nature, space and environment degradation as impacts of the development of our civilization.

It is modern technology, and technique with scientific background and practical value. It can't solve problems by issuing receipts for nature, space and environment damages rehabilitations, but could assist with knowledge, techniques, technologies, management, education, and problem solving at local community life and regional or global scale nature, space and environment issues. It is an assistant for sustainable development, Agenda for Change, and Regional, Country, and Local Agenda 21 processes and sustainable future of local communities, regions, and our civilization.

Environmental issues are very complex and require multidisciplinary approach, research, knowledge, technology, and technique, civil society co-operation, and research, business, finance, society co-ordination or professional management. It is dealing with complex problems and is complex as approach for complex problem solving.

Sustainable development and nature, space and environment protection require mobilization of society, knowledge and large investments, and with eco remediation management, pilot projects, knowledge dissemination, bottom – up approach, multidisciplinary teams and practical work should become important part of world community activities towards sustainable future.

Eco remediation is partner for international, regional, country, and local community, science and research, society, international, regional, country, and local financial institutions, and offers research and business opportunities for entrepreneurs and people of action.

The target is nature, space and environment protection by eco remediation of local hot spots and directed sustainable development of local communities, Agenda 21 processes, local, regional and global community sustainability.

Practical approach is work on environment complex problems solving action within particular local community, as part of the region, country and international society efforts towards sustainability.

Due to investment requirements, which are usually in large numbers, it is necessary to establish practical co-operation between local community, regional, country, international administration and financial institutions, with purpose of making soft connection for investment needed for sustainable development.



ECO REMEDIATION AS COLLEGE TEACHING CENTRE AT GALILEO, ISRAEL

Introduction

Eco remediation is short description of long-term project activity within the Galileo - College community.

Due to specific development of Israel and Galileo – College community, there is problem or heavy burden on space, environment, and nature as well as water supply, water treatment, integral water management, forest and integrated forest management, etc.

To have more complex problem the agriculture needs water for irrigation, production, and also other users of water as industry, business, fire protection, township cleaning, irrigation of parks, watering lawns etc. It is long-term responsibility to handle water issues with care within the Galileo - College community.

Due to buffering and self-treatment abilities eco-remediation (ERM) is most appropriate assistant to integrated water management and nature, space and environment protection of the Galileo - College community.

Also not to forget Galileo – College community has specific location, and pollution of the waters from terrestrial activities has to be taken more seriously. Anyhow any pollution coming from human population should be avoided or controlled at list.

With eco-remediation (ERM) technologies, and techniques implementation we would like to establish economic and ecologic advantage of ERM use within the Galileo - College community both water and terrestrial environments.

The target is to foster sustainable development and social relationship between population and environment protection, protection of people, biodiversity, and rational integrated management of natural resources.

With establishment of Eco Remediation Centre and implementation of the eco remediation technologies, and techniques as sciences, research and business demonstration or initial projects/units within Galileo - College community or the different parts of it, we wish to foster knowledge and use of eco remediation at the Galileo - College, and larger Israel, Middle East, Mediterranean region etc.

Eco-remediation is use of technologies of natural and co-natural prevention/treatment of the nature, space and environment pollution/protection issues.

The definition is not complete without taking into account large multi-disciplinary approach to specific issues of natural resources use, reuse and prevention/treatment, and applied research on one hand, and on the other local population co-operation as co-operation of main partner and beneficiary.

It is even more important within large tourist region hosting large population of tourist.



Implementation targets

The Galileo - College community nature, space and environment due to climate, nature, history, culture and tradition heritage, local nature beauties, recreation and sport opportunities, and population with tolerance of different religions, culture, heritage, etc., is making area as educational and as tourist resort. Due to population and tourist demand and actual capacities, it is necessary to take care of integrated natural resources management, from water pollution prevention, and treatment to the protection of terrestrial and water bodies. This demand is increasing from year to year.

To protect nature, space and environment from intensive burden on natural resources, water supply and polluted water discharge, which are responsible for more and more short natural resources, water supply and bigger pollution, eco remediation should give answer to nature space and environment protection of local environment, and integral use of natural resources. With co-natural treatment of polluted nature near the source of pollution, storing and reuse of natural resources with eco-remediation systems, we think to achieve better co-existence of tourism, local population, nature, space and environment of Galileo – College region.

Water take from surface and underground waters could be mitigated by reuse of treated waters with recycling of treated water through eco-remediation systems.

Target facilities, where is possible to implement ERM are as follows:

Educational Facilities:

Campus and nearby community,

Tourist facilities:

Auto-camps,
Hotels,
Tourist Settlements,
Restaurants and similar,
Tourist agriculture facilities,
Recreational and sport facilities.

Landfills

Co-natural reclamation,
Discharge waters treatment,

Highways, airports, airstrips, city streets waste waters

Waste water treatment by constructed wetlands,

Smaller tourist and local settlements



Waste water treatment by constructed wetlands,

Water sources

Springs protection,
Rivers eco remediation,
Lakes and artificial lakes eco remediation,
Underground water eco remediation,

Protected areas of nature – natural parks

Co-natural rehabilitation,
Wastewater treatment,
Eco remediation of water springs,
Eco remediation of surface waters (rivers/streams, lakes, swamps),

Agro-industrial activities

Oil production – wastewater treatment,
Fruit processing and juices production – wastewater treatment,
Fish processing – wastewater treatment,
Meat processing – wastewater treatment,
Production and processing of vegetables – wastewater treatment,

Agriculture activities

Synthetic chemicals pollution prevention,
Wastewaters treatment,
Irrigation water supply,
Fire protection water supply,

Forestry

Integrated Forest Management
Fire protection water supply

City management activities

Fire protection water supply,
Parks and lawns irrigation water supply,
Streets and squares water cleaning supply,
Wastewater treatment,

Revitalization of degraded water systems

Co-natural reclamation and eco remediation



Eco remediation technologies and techniques are use of natural, co-natural and artificial eco systems for protection of nature, space and environment. Those eco systems have strong buffer, decomposition and storing capacities that is why they are capable to assist by neutralisation, decomposition and compensation of wasted waters.

With eco remediation of natural resources we are fostering natural ability for self-cleaning and rehabilitation of nature and mitigating consequent damages on life and properties. Also nature protection of biodiversity is consequently fostered.

Especial part of eco remediation activity is protection of seas from terrestrial polluted waters. The degree of pollution reflects the state of nature, space and environment protection of catchments area, and due to our civilisation development all estuaries are changed to channels for water transport. It is necessary to make co-natural water treatment of estuaries and to foster consumption of pollutants by wetlands.

The technical facilities of eco remediation for use within Galileo - College community region are as follows:

Constructed wetlands for wastewater treatment,
Constructed wetlands for conditioning of water for reuse in agriculture irrigation,
Constructed wetlands for trice water treatment,
Buffer zones – plant zones and wetlands,
Surface water retain spots, water pools and paddles,
Eco remediation of rivers, river body and banks by co-natural rehabilitation,
Co-natural reclamation of landfills,
Determination of minimal water flow needed for natural functioning of rivers.
Integrated management of different natural resources.

The Eco Remediation College Teaching Centre could have important role for information exchange, scientific, research and applied research work, consulting, technologies, and techniques transfer, promotion and business management.

The Programme

The Eco Remediation College Teaching Centre Project could be scheduled as four (4) phase project, planned as time table and financing covering results and needs.

The Centre will have teaching, learning and implementation parts. As part of College it will have demonstration and practical work role for students, and training of local population. Research activities will be directed toward inventions and innovations of eco remediation activities.

1. Phase

Pilot study of Galileo – College community

- Pre-feasibility and assessment,
- Eco remediation tour of Galileo - College community,
- Agenda 21 for Galileo - College community

2. Phase



Implementation

- Possibility for implementation at Galileo - College community,
- Implementation for specific important local cases – hot spots.

3. Phase

Implementation

- Possibility for implementation at selected specific cases – hot spots,
- Implementation at suitable locations.

4. Phase

Implementation

- Preparation of ready-made solutions and construction of eco remediation economically and ecologically viable cases within Galileo - College community.

Each phase shall have by content defined following aspects:

1. Schedule of economically and ecologically viable ERM projects in comparison with conventional projects.
2. Feasibility study for local important problems,
3. Solution and implementation study and demonstration unit of ERM.
4. Monitoring of the systems.
5. Construction of demonstration ERM technologies, and techniques.

Time schedule of separate phases follows and phases will be implemented according to demands and financial means within 7 years.

Time Table

R = research and development

I = implementation

R : I = 90 : 10	R : I = 40 : 60	R . I = 30 : 70	R . I = 10 : 90
1. Phase	2. Phase	3. Phase	4. Phase
2004	2005	2006	2009 - 2015

Financial construction could be as follows:

	Ratio R : I	Total funds in EUR
1. Phase	90 : 10	0.4 million
2. Phase	40 : 60	2 million
3. Phase	30 : 70	10 millions



Potential partners for financial co-operation are: World Bank, Global Environmental Facility, EU, Israel and local government, etc.

The program is opened for co-operation.

Formal aspects

Eco Remediation College Teaching Centre has been under close checking by many organizations, researchers, business, and administration experts. The general result is positive, and as result there is interest for co-operation of establishment of the Eco Remediation University Teaching Centre, from which we are taking into account two possibilities as follows:

First is by Limnos d.o.o. Ljubljana, Slovenia, and

Second by SEM Institute for Climate Change, Korte, Slovenia which has leading position as international independent scientific, research and applied research institute within nature, space and environment protection (www.institut-climatechange.si) .

Formal aspects:

Name: Eco Remediation Galileo - College Teaching Centre

Registration: by local authorities or as a part of existing organisation

Status: business and scientific, and research institution

Location: Galileo - College

Tax number: issued by local authorities or as a part of existing institution

Employment: minimal permanent management team needed for business, research, and development co-ordination

Technical basis: strong information technology centre with R&D facilities and monitoring, management, business and mobile abilities information technology application

Mode of operation: on project work as field operation and strong research/development and management co-ordination

Management Board: 7 members from business, administration, and scientific community

Scientific Board: 7 members elected from Israel, Galileo - College scientific community and local administration



Supervisory Board: 7 members



Organizational aspects

The Eco Remediation Galileo - College Teaching Centre is putting together two main activities: business management and university teaching scientific, research, development activities.

Management of the Centre will co-ordinate: business activities – from formal to implementation work and management of university teaching and scientific/ research, and development activities; Research and Development will build up the data base of scientific research data, applied research, business, administration and financial institutions.

R&D is support for management and source of on line development, technologies and techniques information and availabilities, projects demands, existence, results and acceptability by local communities etc.

The creative functions will stay with the Centre and all maintenance functions will be managed by on contract basis.

The role of the Boards (management, scientific and supervisory) will be initiative, co-ordination and maintenance of results of eco remediation work.

The Centre will have permanent staff (manager, R&D - two officers and business, and administration two officers), one co-ordinator of external affairs totalling to 6 members, and open membership co-operation with people of good will from World, EU, Israel and Galileo - College.

The membership scheme will include individual (researchers, business people, administrators and others) members, institutional members from local to regional and international business, finance, marketing, media etc. members. The membership in general will be free of charge with provision for contribution possibilities according to the member abilities.

The Centre will have pilot role as first eco-remediation centre on regional basis, and will assist establishment of similar organisations around the country and globe. International co-operation with targeted regions – first neighbouring and secondly others – will be an integral part of the business and operations policies.

Practical work will be done as project work – project manager and needed team will be set together on the basis of approved project with known all business characteristics. Main link for implementation of the project will be co-operation with local communities, regional authorities, business and research communities and others.



Follow up during and after the projects will be done by monitoring, using eco-mobile unit and lab for monitoring and with information technology will act as moving management, and monitoring facility.

Results will be reported annually and approved by internal organisation of the Centre.

Location

The Eco Remediation Galileo - College Teaching Centre will be located as part of College campus.

The location of the Centre will be adequate building with facilities needed for the purpose of management and R&D. Infrastructure, environment and facilities should be adequate for the purpose, and should offer good connections as per information technologies, or transport infrastructure.

Air transport facilities, roads and water transport should be there. Advantage of the location is reasonable cost of building and availability of specific workers.

Also for the initial activities of the Centre – establishment of pilot projects like constructed wetlands, integral natural resources management, eco house, solar energy applications, landfills management, monitoring etc., and researchers will be there.

And finally the policy of the Centre to establish pilot projects around the Galileo - College community are offering good opportunity to establish centres at other location with or without direct co-operation of the Centre within Israel and larger.

Multiplication of the facilities should be possibility for promotion of the eco-remediation within the region, country and larger.

Management

Positive effect of individual manager and work of the Centre Boards should result in fine application of the management.

Both business and College teaching and R&D activities should be result of proper personnel selection. Main activity should remain nature, space and environment eco-remediation as promotion of the pilot, and demonstration projects at local communities of the Galileo - College community.

The eradicated work should be promotion and recommendation of the Centre.

The data base, technologies, techniques and research of the nature, space and environment protection should be available for further applications, and the whole Galileo - College



community, country and larger should benefit, and should have good possibility to know, use and adopt knowledge, technologies, and techniques invented, researched and used by action of the Centre.

Finance

The implementation of the eco remediation activities within our reach, we think the financing of the activity is a key for success. We are making two parts of financing as initial requirement for implementation. First are the finances needed for infrastructure of the Center.

Initial investment cost:

Item	Investment coast in EUR
Building and construction	500.000
Information technology	30.000
Basic inventory	70.000
Mobile Eco Lab	120.000
Working capital	300.000
Total	1.020.000

Initial investment cost includes investment cost and operational cost of first year of the operation. It is basic part of financial structure and should assist establishment of the Centre. Also establishment cost and expenditure before the operation are included. Actually it is finances needed for establishment and first year of operations.

Items Mobile Eco Lab and Information technologies equipment are very important, because they have to provide the advantage of the Centre communications and monitoring ability.

Second part is making annual operational cost financing, which should be done on the basis of the work of the Centre and business results.



Our estimates are in range of 40.000 EUR per month and should be covered by the Centre activities, as contribution from the projects, monitoring and financial activities, and secondly from contributions from membership.

The Centre operations should generate the investment opportunities in large amounts, and with working background of **eco remediation on the R&D** objectives the Centre is best partner for co-operation with investment financial institutions.
It is business option on which the Centre is feasible.

Conclusion

The state of nature, space and environment are opening many opportunities for eco-remediation and sustainable development, which are preconditions for reasonable quality of environment.

Eco remediation technology and techniques represent possibilities for rehabilitation of the damaged environment by impact of our civilisation. The sustainable development and eco remediation is hand and glove for sustainable future of the Galileo - College region and other regions of the country and globe.

The investment into establishment and activities of the Eco Remediation Galileo - College Teaching Centre is not only opportunity, but also assistance for sustainable development and sustainable future of the community, region and more.

With establishment of the Centre first step could be done towards improvement of the environment conditions within the Galileo - College community.

Medosi, Slovenia, October 2004

Dr. Timi Ecimovic

2.

BOSNIA AND HERZEGOVINA FRESHWATER FISH PRODUCTION AND MARKETS STUDY

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Bosnia and Herzegovina freshwater production and market study has been initialized by UN FAO as one of information needed for possible Surveillance programme in aquaculture farms.

Anthology 2 – 2001 - 2014



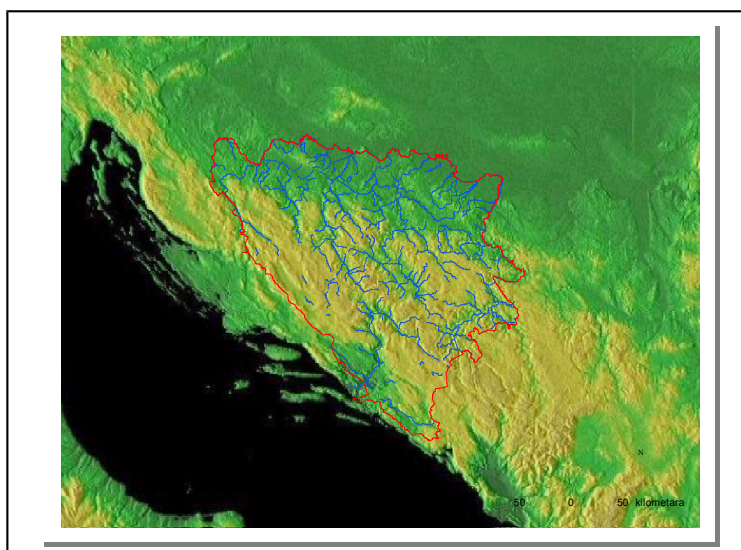
Introduction

Bosnia and Herzegovina as newly emerged country from former Yugoslavia (1992) has been war zone from 1992 till 1995. From 1995 onward has been divided into two separate entities Federation of Bosnia and Herzegovina, and Republic of Srpska. Joint body for governing is Joint Presidency and Parliament. At present there are different laws and constitutions for both. Joint laws are those of mutual importance, or enforced by International Community, who is assisting in governing of the country.

Recently there is progress with acceptance of needed laws for both entities, due to recognition of needs for international involvements of both entities.

Talking of freshwater fish production in Bosnia and Herzegovina before war, during war, and after war increased production has been recorded (Hamzic, Akvakultura u Bosni i Hercegovini, 2003).

1. Country Profile – Bosnia and Herzegovina



Bosnia and Herzegovina (BIH) is located in the South-Eastern Europe on Balkan Peninsula. In total Bosnia and Herzegovina has area of the country of 51209.2 km² (Statistical data www.fys.ba/BihB/opcistatpodaciobih), out of which land area is 51.197 km², and area of the Adriatic Sea is 12.2 km². The total length of the land boundaries is 1459 km. Neighbouring countries are Croatia (932 km) to the North-West, and South, and Serbia and Montenegro (527 km) to the East.

Major rivers and lakes according to geographical data are in more as one country, or are bordering environments. The waters of B&H have two general directions northward to Sava River, which flows to Danube River near Belgrade the capitol of Serbia and Montenegro Republic, and southward to Adriatic Sea.



Southward waters have more endemic fish species due to close environment and close distance of sea waters.

Majority of rivers have origin of karst underground waters and strong springs. With development of hydroelectric power stations river environments have been changed due to reservoirs, dams and consequent environmental changes.

The biota due to new conditions has been changing, and new fish species have been introduced.

The rivers are listed as follows:

B&H Rivers

<i>Name</i>	<i>Altitude</i>		<i>Spring end dif.</i>	<i>Length in km</i>	
	<i>Spring or entry point</i>	<i>End</i>		<i>Total</i>	<i>In B&H</i>
SAVA	94	87	7	945	331
Una	520	94	426	212	212
Unac	600	300	300	58	58
Sana	940	139	801	140,4	140,4
Vrbas	1780	93	1687	192	192
Vrbanja	1520	164	1356	70,5	70,5
Ukrina	120	96	24	53,3	53,3
Bosna	660	89	471	271	271
Krivaja	560	200	360	65,5	65,5
Spreča	300	143	157	112,3	112,3
Usora	880	145	735	77	77
Tolisa	440	81	359	56,2	56,2
Tinja	500	80	420	69	69
Drina	433	87	346	346	346
Čehotina	1250	340	910	91	33
Lim	901	299	602	197	40,5
Prača	1460	329	1131	56,9	56,9
Drinjača	730	141	589	78,5	78,5
Janja	600	94	506	53,3	53,3
NERETVA	1320	0	1320	225	218
TREBIŠNJICA	398	224	174	96,5	96,5



The B&H lakes are listed as follows:

B&H Lakes

<i>Name</i>	<i>Town</i>	<i>Area in km²</i>	<i>Elevation in m.</i>	<i>Deepest in m</i>	<i>Volume in mil.m³</i>
Buško	Tomislav grad Livno	55,8	716,5	17,3	782
Blidinje	Tomislav grad Posušje	3,2	1180	4,5	-
Boračko	Konjic	0,26	402	17,1	-
Jablaničko	Jablanica Konjic	13,3	270	70	270
Modrac	Tuzla Lukavac Zivinice	17,1	200	17	100
Plivsko	Jajce	1,148	424	36,2	21
Perucacko	Visegrad	12,4	290	70	340
Ramsko	Prozor Rama	15,3	595	-	1.160
Zvornicko	Zvornik	8,1	140	28	42
Bilecko	Bileca Trebinje	-	-	100	3.764

The country geographical and geological data's explains very heterogeneous geological foundation, where dominant role play carbonate rocks such as limestone and dolomite, while in certain areas, such as the central and the eastern parts of the country, silicate rocks and alluvium of various geological age could be found. This diversity compounded by glaciations, together with different climate types and various soil characteristics gave raise of rich biodiversity. The biota is large and not even fully explored.

Karst is main land environment. Reflecting this also many rivers have karst springs with high water quality, and dramatic water flow in thousand litres per second.

1.1. General information about inland waters

There are 11 main river basins in the country. In general, all of them belong to Black Sea basin and Adriatic Sea basin. Main flow of the Black sea basin is the River Sava, to which run almost all northward waterways in the country. The River Neretva is the only direct tributary to the



Adriatic Sea. Within karst of the country there are many underground rivers and lakes, from where are coming rivers, which may have also temporary character.

The climate within B&H is moderate and humid with reasonable rains. Before the climate change system changes heaviest rains were in November and December.

Although very rich in freshwaters, Bosnia and Herzegovina have just a few lakes. The largest lake is Boracko Lake, in the South-Eastern part of the country, in the eastern foothills of Mt. Prenj. Blidinjsko Lake situated in Dugo polje, almost dries out during the summer. In the lower course of the Neretva River, in area Derane – Svitava, there are several lakes which depending on the water level cover large areas, and sometimes their size significantly reduces. There are also numerous lakes on the highest mountains in the country. Those are mainly glacial lakes located in the Central Bosnia, and on the mountains within the Eastern and South-Eastern part of country (Mt. Cvrsnica, Treskavica, Zelengora, Volujak, etc.). Within the River Una and the River Pliva there are numerous travertine lakes. Reservoirs have been built on the River Vrbas (Boca – 233 ha), Drina (Visegrad reservoir), Neretva (Jablanica lake – 1,440 ha; Grabovica – 130 ha; Salakovac – 310 ha; Mostar reservoir – 130 ha; and Rama Lake – 1,160 ha), and on the River Trebinjica (Bileca Lake – 3,764 ha and Trebinje Lake – 171 ha). All of them are larger than natural lakes.

Partly natural lakes and reservoirs are suitable for aquaculture of trout and white fish species, using cages technology. High quality production has been already achieved in growth of trout species in lakes Bocac and Salakovac.

Present level of production does allow space for additional production. Enlargement has close connection with possibilities for export, but actually B&H lack of government central ability is main obstacle for enlargement of production. On the other side there are many after war gained abilities of population living in vicinity of waters to have fish diet as part of sport activity.

In following tables there are data on rivers and lakes taken from statistical sources.

(<http://www.fys.ba>)

Hydrologic features of main river basins in B&H

River basin	Area (km ²)	Population in 1991	Mean discharge (m ³ /s)	Minimum discharge (m ³ /s)	Average specific runoff (Q _{avg} /A) (l/s/ m ³)
Sava (nearby basin)	5,506	635,353	63	1.5	11.44
Una (in BiH)	9,130	620,373	240	41.9	26.29
Vrbas	6,386	514,038	132	26.3	20.67
Bosna	10,457	1,820,080	163	24.2	15.59
Drina (in BiH)	7,420	422,422	124	24.1	17.13
Black Sea	38,719	4,012,266	722	118	18.65
Neretva and	10,110	436,271	402	56.5	39.76



Trebinjica					
Cetina (in BiH)	2,300	79,089	31	1.8	13.48
Adriatic Sea	12,410	515,360	433	538	34.89
<i>Total in BiH</i>	51,129	4,527,626	1,155	176.3	22.9

1. 2. General features of freshwater fish in Bosnia and Herzegovina

Fauna of Bosnia and Herzegovina has been determined in a large extent by dynamics and intensity of uplifting of sea and land in geological past of this area. Present distribution and the structure of the living world in Bosnia and Herzegovina have been mainly determined after last glacial time. Since mountain glacial process had influence only to the highest mountain peaks, in other regions, depending on the climatic conditions at that time (i.e., shifts in warmer and colder periods), regional migrations took place, and mixed fauna has been gradually evolved to the new life conditions. For these reasons, today in the flora of the country exist ancient species (1) those which have survived glacial period (Tertiary and glacial relics), (2) species originating from the northern and the southern parts of Europe, (3) species from Asia, (4) significant number of new (sub)species – originating from America and elsewhere or neighbouring territories (endemics).

Changes in general geological and hydrological conditions, and particularly forming and destruction of natural isolation barriers in geological past have very pronounced impacts on the development and composition of living world in waterways and lakes. Ichthyofauna of Bosnia and Herzegovina represents a unique European biological resource considering both total richness and presence of numerous interesting endemic forms. Although its features have been mentioned in records from the medieval time, and although it has been in the focus of serious and complex scientific investigations, it is still not completely researched. This could be stated not only for the most modern aspects (molecular-genetics, cytogenetic, etc.), but also for classical biosystematical and ecological methods and approaches to the biodiversity analysis.

Major part of the most important contributions to the knowledge of ichthyofauna in the country has been published in the works of the following researchers: Heckel and Kner (1858); Steindachner (1882); Karaman (1928, 1932, 1963, 1966); Taler (1953); Zaplata and Taler (1932); Vukovic (1963, 1977, 1980); Vukovic, Ivanovic (1971); Sofradzija (1977, 1999); Sofradzija, Berberovic (1972); Sofradzija, Hadziselimovic (1981), etc.

Present research due to specific political, social and economic development of the country is not yet in situation to contribute enlargement. Indication of endemic species as ancient freshwater crabs, Human fish - *Proteus Sanguinus* and life of freshwater in B&H are asking for more research. Unfortunately present organisation of Central Government does not provide environment for research work.

Importance of research of ichthyofauna and other parts of freshwater environments plays very important role for the development of economic life of society along the water environment, and more efforts in future should be put into its research.



Fish population of Bosnia and Herzegovina includes two sub regions Northern – Black Sea basin and Southern – Adriatic Sea basin distinguished on the basis of the most important qualitative and quantitative features. (1) Fish population of the freshwater in the Adriatic Sea basin is rich with endemic forms of various bio systematic species, (including various categories of steno endemics and euri endemics from the South-Eastern Europe).

Due to karst basic characteristic of the Herzegovina, from where are River Neretva and River Trebisnjica main two freshwater systems. One of them River Neretva ends at Adriatic Sea, and other River Trebisnjica ends underground, and both have been reach with endemic freshwater species like: Big-head Trout, Soft-mouth Trout, etc.

Within last 150 years there have been significant changes in life conditions of freshwater life in B&H due to construction of hydroelectric facilities and consequent changes of river environments. To have more changes people living near rivers have been introducing new species as cat fish, grayling, carp, rainbow trout etc. who had different impacts to existing species. Actually both big-head and soft-mouth trout at Neretva River basin are on the edge of disappearance.

Conservation work should start soon to preserve those species, which are endemic of the Neretva River freshwater system. The happening is similar to other parts of the Earth, but due to recent war and consequent economic and social development, there is lack of funds, researchers and facilities for conservation work.

Endemic fish species in Bosnia and Herzegovina

Species	Neretva river basin	Hutovo Blato	Busko lake	Klinje lake	Trebisnjica river basin	Duvno Waters around Livno and
1. <i>Salmothymus obtusirostris oxyrhynchus</i> Steindacher, 1882	X					
2. <i>Salmo marmoratus</i> Cuvier, 1829	X	X				
3. <i>Salmo dentex</i> (Heckel, 1851)	X	X				
4. <i>Aulopyge huegelii</i> Heckel, 1843	X		X			X
5. <i>Chondrostoma phoxinus</i> Heckel, 1843			X			X



6. <i>Chondrostoma knerii</i> Heckel, 1843	X		X			
7. <i>Phoxinellus adspersus</i> (Heckel, 1843)	X					X
8. <i>Phoxinellus alepidotus</i> (Heckel, 1843)	X	X	X			
9. <i>Phoxinellus pstrosi</i> (Steindacher, 1882)					X	
10. <i>Phoxinellus metohiensis</i> (Steindacher, 1901)				X	X	
11. <i>Phoxinellus ghetaldi</i> (Steindacher, 1882)		X			X	
12. <i>Leuciscus tursky tursky</i> (Heckel, 1843)		X			X	X
13. <i>Leuciscus svallize</i> Heckel & Kner, 1858	X	X			X	

(2) There are no endemics in fish population in the waters of Black sea basin. These waters are rich in fish species with wider European distribution.

Ichthyofauna of Bosnia and Herzegovina includes 138 (sub)species from 69 genera and 27 families. In total, 19 families are represented with just one genus. Out of this number, 16 families have just one species. The richest genetically and species biodiversity is present in the family *Ciprinidae* (26 genera – 51 species) and in the family *Salmonidae* (8 species from 5 genera). More than one species is present in families *Acipenseridae* (2 genera and 7 species), *Mugilidae* (1 genus and 6 species), *Percidae* (4 genera and 7 species), *Cobitidae* (3 genera and 6 species), *Clupeidae* (1 genus and 3 species), *Gasterosteidae* (2 genera and 2 species), *Gobiidae* (5 genera and 7 species) and *Cottidae* (1 genus and 2 species).

Only 7 out of 27 families are present in the Black Sea basin, 12 in the Adriatic Sea basin, while representatives from 8 families are present in both basins.

The results of the analysis of the biodiversity of ichthyofauna in Bosnia and Herzegovina on generic level indicate that out of the total number of genera (69), 28 genera live only in the Black sea basin, 16 genera live only in the Adriatic sea basin, while 25 genera has its representatives in both river basins.

Out of the total number of fish (sub)species (138), 48.7% is registered only in the Black sea basin, 39.5% in the Adriatic sea basin, and 11.8% in both basins. Considering these data, waters of the Black sea basin are distinguished by the higher biodiversity level. Relatively small number of species could be found in the both basins, and even among them certain number of species from the Black sea basin has been introduced into the waters of the Adriatic sea basin (carp, zander, tench, and grayling). To this number should be added 11 alochtonous species originating from other Eurasian and even American waters.

In some time it is proof of favourable environmental conditions for fish farming.



1. 3. Legal and organizational basis of inland freshwater fishery management

Political Environment

Bosnia and Herzegovina became an independent state in 1992 and immediately afterwards entered into a 3.5 years-long war. The war was ended in the winter of 1995 by the Dayton Peace Agreement, of which Annex 4 represents the Constitution of Bosnia and Herzegovina. According to the Constitution (1995), Bosnia and Herzegovina is composed of two Entities: the Federation of Bosnia and Herzegovina (FBiH) and Republic Srpska (RS). The Federation consists of ten cantons, which in turn consist of municipalities. Each canton has its own constitution and government. Republic Srpska has no cantons, only municipalities.

Institutional Settings

The Constitution does not explicitly assert rights to the environment and to access to environmental information, as it was the case with the constitution of the former Yugoslavia. In Republic Srpska, a right to a healthy environment is incorporated in the Constitution that was adopted in 1994. According to the Constitution of BIH, the environment is under the authority of the Entities. There is an environmental ministry in both Entities: in FBiH the Federal Ministry of Physical Planning and the Environment, in RS the Ministry of Urbanism, Housing, Public Utilities, Civil Engineering and Ecology. In FBiH, there is also a ministry for the environment in each of the ten Cantons, and both the Federation and the Cantons are jointly responsible for the environment (REC, 2000).

Because of the complicated political situation, which followed the war, there was very little co-operation between the Entities regarding environmental matters. In order to overcome the problem of non-cooperation, an Environmental Steering Committee was established in the summer of 1998, with help from the Regional Environmental Centre for Central and Eastern Europe (REC). The Committee consists of eight members, four from each Entity, and several non-voting members, representatives of international organizations, such as the Office of the High Representative (OHR), USAID, the World Bank, and the European Commission (Csagoly, 1998).

The Committee is responsible for: "harmonisation of environmental legislation and regulation, standards and action programs, international treaties concerning the environment, and their implementation; involvement in international processes such as Environment for Europe; cooperation with international organisations such as UNEP and the European Environmental Agency, and relations with the donor community; environmental monitoring and information systems and plans for emergency situations; physical planning concerning the environment, information collection and exchange; trans boundary and inter-entity environmental issues, including cooperation with neighbouring countries on environmental matters, and co-ordination of all environmental activities incident to the admission of BIH as a Member State of the EU." (Csagoly, 1998)

Lately during 2004 Bosnia and Herzegovina, Ministry of Foreign Trade and Economic relations established State Veterinary Administration (Ecimovic/Hamzic 2004).

Environmental Legislation



According to the Dayton Peace Agreement, all legislation belonging to the former Socialist Republic of Bosnia and Herzegovina that was not inconsistent with the Dayton Peace Accords may stay in force. Hence, the Law on Urban Planning, adopted in 1974, which covers the environment and nature protection, is still in force in FBiH (Kurbegovic, 1998).

Environmental legislation has been prepared through an EC project named "Preparation of Environmental Law and Policy in BiH" (REC, 2000).

According to the Government (2002) the following legislation is currently under parliamentary discussion: Draft Law on the Protection of the Environment, Draft Law on the Protection of the Waters, Draft Law on the Protection of the Nature, Draft Law on Waste Management, and Draft Law on the Protection of the Air.

In all countries in the South-Eastern Europe there are national strategies and action plans. Since March 2001, The World Bank supported development of the National Environmental Action Plan (NEAP), which was finished by the end of the year 2002. The role of NEAP was to identify major environmental problems in the country, and to set the list of priorities. NEAP is a very important document for Bosnia and Herzegovina, and it is adopted by both entities and Brcko District.

International Conventions

Bosnia and Herzegovina has ratified or signed some of the most important international conventions and agreements related to natural resources, including:

- The Vienna Convention for the Protection of the Ozone Layer (1985) 6.3.1992;
- The Montreal Protocol on Substances that Deplete the Ozone Layer (1987) 16.3.1992;
- Convention on Long-Range Trans-boundary Air Pollution (13 Nov 79); and Protocol on EMEP Financing, 1984;
- Convention Concerning the Protection of the World Cultural and Natural Heritage (16 Nov 72);
- Convention on Fishing & Conservation of Living Resources of the High Seas (29 Apr 58);
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, (London, December 29, 1972).
- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona 1976)
- Protocol concerning Co-operation in Combating Pollution of the Mediterranean Sea by Oil and other Harmful Substances in Cases of Emergency (Barcelona 1976)
- Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (Athens 1980)
- Protocol concerning Mediterranean Specially Protected Areas (Geneva 1982)
- United Nations Convention on the Law of the Sea (Montego Bay 1982)
- Protocol to the Convention on Long-Range Trans-boundary Air Pollution on Long-Term Financing of Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP) (Geneva 1984)
- Convention on the Prohibition of the Use, Stock-piling, Production and Transfer of Anti-Personnel Mines and on their Destruction (Oslo 1997)



- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (Basel 1989)
- UN Framework Convention on Climate Change (Rio de Janeiro 1992)
- The Ramsar Convention on Wetlands (Ramsar 1971).
- Biodiversity Convention (Rio 1992)

There were non communication exchanges among scientific institutions, sport fisherman associations, environmental NGO's and fish producers during the war according to the Dayton Peace Accord (1995). Gradually communications were re-established with assistance of foreign and local experts. Current situation is as follows:

a) Sport fishing

- There is no joint presidency for associations of sport fisherman in the country,
- In Republic of Srpska the fisherman associations are organized at the municipality level, and currently there are 48,
- In Federation of BiH the fisherman associations are divided into 10 Cantonal associations, and they are again divided into 74 municipality associations,
- Number of members with license is estimated at 35 000 (FBiH – 22 000, and RS – 13 000),
- There are two laws on freshwater fishery (FBiH and RS), and main law has not yet been adopted. These laws have not been implemented in practice. On 5th October 2004 new law on freshwater fishery was introduced,
- Most part of sport fishermen associations are not working or they are working with limited capacities,
- Besides Una-Sana canton all other associations are in a very poor conditions,
- A large percentage of the associations are not capable to organize environment and fishing protection service,
- The large number of the fisherman associations carry out re-stocking of waters and management without scientific and expert advice or education,
- There are non-statistics of taken fish, their size or weight,
- There is no strategy of development of sport fishing at the country level,
- The national competition at the state level (from municipality to the state level) has been established three years ago,

b) Commercial fishing

- Commercial fishing in the country is registered on the Sava River and at the Neum area (Adriatic sea),
- Only 6 fishermen are registered for this activity at the Sava River, but there are non-statistics of their work and catch,
- At the Adriatic Sea (Neum municipality) 2 fishermen are registered, but there are non-statistics of their work.

c) Sport and commercial fishing

- This activity has been successful within Una-Sana Canton, where sport fishermen are managing certain areas of the rivers Unac and Klokot. The same situation is on the Lake Boracko near Konjic Municipality. It was estimated that more than 250 foreign and some 400 local fishermen visited these areas during the year 2003. The



organization of this type of sport fishing is suitable, and it generates income for sport fishermen associations, which they have been using for re-stocking of fish stock of these areas and protection service.

d) Aquaculture

- There are two organizations of producers of freshwater and marine fish in Bosnia and Herzegovina, one at each entity,
- There are two laws on freshwater fishery that are contradictory in numerous issues, and new law was introduced on 5th October 2004,
- There is no main law at the state level,
- Numerous fish farms operate without registration whatsoever,
- There are non-waste water treatment (mechanical or biological) at fish farms,
- Only two fish farms use containers for dead fish, other farms does not use containers for dead fish, and at the those fish farms dead fish are usually disposed directly into the open waters,
- There are some 40 trout fish farms with concrete ponds, 20 trout fish farms with cage technology, 5 cyprinid fish farms with land/ground ponds and 2 marine fish farms with cage technology.

1. 4. Participation of fisherman and fishery administration at integrated resource management for sustainable inland freshwater fish production

There are non-synchronized co-ordination between fishermen and administration in the country. Previous joint activities were locally organized. For these reasons, today there are divided riverbanks at all parts of the country. The state has not still adopted laws that would enforce fishermen to obey European and other international standards for the resource management.

1. 5. Indicators for sustainable freshwater fish management of inland water fishery

There are the following indicators that could be used for management:

- Endangered species protection,
- Restrictions of length of fish catch,
- Restriction of number of fish, which could be taken,
- Fishing seasons,
- Closed water areas,
- Permits for sport/recreational fishing,
- Fishing with barb less/de-barber or barb squeezed down flat hooks, or hooks with barb,
- Fishing on Catch and Release system,
- Efficiency of fishing watch system, and co-operation with police,
- Organizational efficiency of fisherman associations,
- Freshwater environment protection control and Spatial planning



Unfortunately almost all above-mentioned indicators are not implemented in the practice and there are many breaks of these limitations. Actually there are missing basic relationship between water/river/lake environment and population as well as fisherman. Of course it has to do a lot with education of the population and fisherman on biology and environmental protection of nature systems.

1.6. Fishery in inland water

There are no data on fish catch at both recreational and commercial fishery sector. For these reasons it is not possible to provide reliable catch statistics, including commercial values. Due to the aggravated living conditions and high unemployment rate in the country, the number of registered recreational fisherman has been decreased significantly, while the number of illegal fisherman increased. Currently, there are numerous illegal tools for fish catching in use (nets, explosive, electric aggregate, etc.).

In Bosnia and Herzegovina today there are the following sport fisherman associations:

- 2 entity associations, and one in Brcko District,
- 10 Cantonal associations in FB&H,
- 122 municipality associations (FB&H 74, RS 48),
- Members with permits are estimated at 35 000.

Main part of the activities in these associations has been organized on voluntary basis, but there are some 70 people that receive regular salary. A larger part of the professionals in these organizations receive their salaries from fishing permits, while a very low number of them are at municipality budget. There are just a few associations that have their own premises. In RS there is one publication that has been published twice a year. The main reason for above described situation is lack of funds.

1. 7. Interaction between commercial and recreational fishery

Legal commercial catch in the country is insignificant, and it almost does not exist, and therefore its impact on the sport fishing is a very small. Much higher impacts have illegal fishing, which catch are put on the market illegally. They do not choose means, time and species, causing significant damages on commercially important freshwater fish species, and immense damages to endemic and autochthonous trout species.

1. 8. Influences from other sectors and limitations on inland water fishery

Main impacts on inland fresh fishery in Bosnia and Herzegovina are as follows:

- Hydro-electric-power stations and dams (they do not have a fish migration trails),
- Waste waters from municipalities and industry sector (there are only 7 waste water treatment plants in the whole country),



- Aquaculture – is not well organized, and is not regulated by common law. At some places is possible to find number of aquaculture production one by one, and last one is getting from all others package of bad impacts,
- Agriculture, with unknown quantity of synthetic chemicals from pesticides, fertilizers and plastics,
- Transport, with large input of polluted waters directly discharged into open waters,
- Tourist activities (waste disposal, rafting, disturbance at spawning sites, etc.),
- There are no funds from state designated for production of fry and fingerlings of autochthonous species,

1. 9. Conflict between water resource user groups

The main conflict in water resources use are between agriculture sector that use water for irrigation of arable land with simultaneous discharge of fertilizers in waterways. Significant oscillations in water levels especially during summer time caused by water use for production of electricity particularly endanger cyprinid species. Significant problem represent also direct discharge of industrial wastewaters into waterways and illegal fishing.

1. 10. Environmental aspects of inland water fishery

This issue should be discussed in the context of general environmental protection of the terrestrial and water environments (agriculture pollution by synthetic chemical agents, illegal deforestation, soil erosion, illegal dumping sites, land use change – conversion from forests to agriculture, etc.).

Introduction of strange/new fish species (mainly illegally) is serious problem that has impacts on ecological balance of the river environment.

The climate change system changes problems which are evolving should be addressed, and mitigation of their impacts should be considered. B&H as water reach country may find herself in not so many reach water country position in future.

1. 11. Physical modifications of the aquatic habitat

Main physical modification on waters in the country represents construction of dams. They are mainly located at the river Neretva (system of 5 dams), river Trebisnjica (3 dams), river Drina, river Una, river Vrbas, etc.

In certain part of the country construction of flood protection facilities have also impacts on fish migration routes and spawning sites.

This trend of dam construction and building of hydro-electric-power stations has been continued. There are plans to build in a very short period a new 5 plants without previous environmental impact assessment are emerging.

1. 12. Rehabilitation of lakes and reservoirs for fish



There are no current significant activities on the rehabilitations and restoration. There were in the period before the war certain attempts on introduction of grass carp and silver carp to control aquatic plants in certain lakes and reservoirs in the country.

1. 13. Bio-manipulation, stocking and introductions

Introduction of new species practice has been continued after the war, numerous exotic fish species have been introduced intentionally or not intentionally at inland freshwaters in Bosnia and Herzegovina. They have negative impacts on autochthonous fish populations. These introductions have happened without any control and advice from scientific institutions. Sport fishermen are mainly responsible for the current situation. The fish species have been introduced without any isolation (quarantine) and veterinary analysis.

Also their biological impact was not known. Today we have many problems, which should not be. Introduction of Rainbow Trout has impact on brown trout population; introduction of grayling into Neretva River basin has serious impact on soft-mouth trout population. Within Neretva River artificial lakes environments we have today carps, catfish and some others species, which should not be there. All this has diminished value of the environment, and it is difficult to measure damages.

With emerging climate change system changes it may be even worse, due to change at environment itself – temperature, wind, soil erosion, desertification, droughts and floods, quantity of rain waters in time units, and biota of the local environment. Many water plants, which are successful today, may not be found tomorrow. Due to complex nature of environments it is difficult to recognize all aspects and influences of introduction of new species.

Significant case of bad impact was introduction of Nile Perch into Lake Tanganyika! As result the whole biota was changed.

A list of exotic fish species introduced into B&H

Species	Rivers and Lakes
<i>Oncorhynchus mykiss</i> (Walbaum, 1792)	Vrbas, Bosna, Drina, Una, Sana, Neretva, Trebisnjica, Busko lake, Boracko lake
<i>Salvelinus fontinalis</i> (Mitchill, 1814)	Vrbas, Bosna, Neretva, Una, Sana, Trebisnjica, Ramsko lake, Boracko lake
<i>Salvelinus alpinus</i> (Linnaeus, 1758)	Vrbas, Bosna, Neretva, Trebisnjica, Ramsko lake, Lake Klinje
<i>Carassius auratus gibelio</i> Bloch, 1782	Sava, Vrbas, Bosna, Drina, Neretva, Trebisnjica, Boracko lake,
<i>Pseudorasbora parva</i> (Temminck & Schlegel, 1846)	Sava, Vrbas, Una, Ukrina,
<i>Ctenopharyngodon idella</i> (Valenciennes, 1844)	Vrbas, Bosna, Drina, Una, Sana, Ukrina, Sava, Neretva, Trebisnjica
<i>Hypophthalmichthys molitrix</i> Valenciennes, 1844	Vrbas, Sava, Sana, Trebisnjica, Busko lake, Lake klinje



<i>Aristichthys nobilis</i> (Richardson, 1845)	Ukrina, Sava
<i>Gambusia affinis</i> (Baird & Girard, 1853)	Neretva
<i>Lepomis gibbosus</i> (Linnaeus, 1758)	Vrbas, Bosna, Drina, Una, Sana, Ukrina, Sava, Neretva, Trebisnjica
<i>Ameiurus nebulosus</i> (Lesueur, 1919)	Vrbas, Bosna, Drina, Una, Sana, Sava, Neretva, Trebisnjica

Besides fish species imported from other states and regions in Bosnia and Herzegovina, significant negative impacts on autohtonomous ichthyofauna of the Adriatic sea basin have also other fish species introduced from Black sea basin, such as catfish (*Silurus glanis*), grayling (*Thymallus thymallus*), Stizostedion lucioperca, etc. An example of negative impact on endemic salmonide species is introduction of grayling into the waters of the river Neretva that is (particularly in the upper course of the river) almost put at the verge of extinction species soft mouth trout (*Salmothymus obtusirostris oxyrhynchus*) and big-head or adria trout (*Salmo marmoratus*).

Exact date of introduction has not been known since it was done illegally without asking or informing of experts (estimated date is 15 years ago).

1. 14. Fish diseases and their control

At the Veterinary Faculty in Sarajevo, the only institution of the kind existing at present in Bosnia and Herzegovina, there is a Centre for Fish Diseases, which has for 44 years now working on health protection of fish farms (trout and cyprinid) in Bosnia and Herzegovina. Besides the farms in Bosnia and Herzegovina, the Centre used to cover all the fisheries in past Yugoslavia like Montenegro, Sandzak and a part of Kosovo.

The Centre for Fish Diseases is dealing primarily with diagnostics, prevention and control of contagious and parasitic diseases in fish managed farming.

Established and diagnosed the most important fish disease in B&H has been as follows:

Intestine red mouth disease

Bacterial kidney disease

Furunculosis of trout

Erythrodermatitis cyprini

In tables below, there are records for 2001 - 2003 years for fish farms, which are under control of Centre of fish diseases. Centre had and have contract with this fish farms for control, prevention, diagnostics and treatments of fish diseases (control at least 6 times per year). Centre and other laboratories at Veterinary faculty (like laboratories for microbiology, pathology, nutrition, hygiene, and toxicology) are working together. Diseases prevention and control is done at farms and the laboratories. For virus prevention and control are in use commercial ELISA kits. For prevention and control of bacterial diseases, there are in use cultivation and identification. For parasite examination there are in use parasitological standard methods.



List of fish farms in B&H under control through period 2001-2003

	Years	2001	2002	2003
No	Salmon fish farms			
1	NorFish, Blagaj	X	X	X
2	Riz Krajina, Bihac	X	X	X
3	Krupic, Prozor/Rama	-	-	X
4	Okasnica-Ovako, Bugojno	X	X	X
5	Salmon, Ljubuski	-	-	X
6	Riba Neretva, Konjic	X	X	X
7	Zunovnica, Hadzici	X	X	X
	Sea fish farms			
1	Ancora Comerc, Neum	-	-	X

List of fish diseases at fish farms in B&H through period 2001-2003

	Years	2001	2002	2003
No	Salmon fish farms	FISH DISEASES		
1*	Norfish, Blagaj	Yersiniosis	NO	NO
2*	Tropic, Banja Luka	No control		
3*	Riz Krajina, Bihac	NO	Furunculosis	NO
4*	Lake, Mrkonjic Grad	No control		
5	Krupic, Prozor/Rama	-	-	NO
6	Okasnica-Ovako, Bugojno	NO	NO	NO
7*	Salmon, Ljubuski	-	-	NO
8*	Riba Neretva, Konjic	Furunculosis	-	NO
9	Zunovnica, Hadzici	NO	NO	NO
10*	Jazina, Trebinje	No Control		
	Cyprinid fish farms			
	None	No control		
	Sea fish farms			
1	Ancora Comerc, Neum	-	-	NO

*After invitation without official contract and control

2*- during one experiment (October and November 2000) find Bacterial kidney disease, Furunculosis and Yersiniosis at rainbow trout.

4* - during 2001 (two times) and 2002 (one times) it was not found any infective diseases.

7* - during 2001(one times) and 2002 (one times) it was not found any infective diseases.

10* - during 2002 (one times) it was not found any infective diseases

*Note: for fish farms in Federation B&H under control

The infected farms were treated, and prevention and treatment was directed toward the eradication measures. During infection period, fish farms did not trade with fry and older category of fish.

1. 14. Aquatic environmental hazard assessment



There are no systematic impact assessments of the potential hazards on the aquatic environment. The assessment has been carrying out only in the case of the accidents such as discharge of hazardous substances in water bodies from industrial sources, car accidents (oil tankers), etc.

Monitoring of the both quality and quantity of waters is organized only at the Una River basin. It has been carried out by Swiss Agency for Development and Cooperation (SDC) and Consulting Engineers, Water Specialists – IBG.

Up to date, only on Bocac Lake on the river Vrbas was carried out analysis of the impact of aquaculture on the aquatic living world.

Also, Regional Environmental Center (REC) Country Office Bosnia and Herzegovina in cooperation with Norwegian government has supported assessment on the part of the river Neretva.

1. 15. Inland freshwater fishery research

During the war, main part of documentation and archive was destroyed. Since 1996, listing of ichthyofauna, zoobenthos, phytobenthos and plankton has been carried out in the following sites: Bihac – Una River, Konjic Neretva River, Jablanica – Neretva River, Mostar – Neretva River, Gracanica – Spreca River, Sarajevo canton – Bosna River basin. This makes some 15% of total freshwater resources in the country.

The results of the analysis have shown that quantitative and qualitative composition of ichthyofauna at investigated sites has been improved due to the non activities of heavy industry. Aggravated conditions are recorded with autochthonous freshwater species (Centre for Ichthyology and Fishery).

It has been done research on the production of soft mouth trout fry for re-stocking at Neretva River and other rivers, on fish farm in Blagaj, on Buna River.

During last two years, Institute for Genetic Engineering and Biotechnology has been doing genetic structure investigation of autochthonous species of brown trout *Salmo trutta m. fario*.

1. 16. Education and training in inland freshwater fishery

There is no separate study group designated exclusively to ichthyology, fishery and aquaculture. In curricula and syllabi of certain universities in the country (Sarajevo, Banja Luka, and Mostar) there are one-semester courses dealing with this issues. Also on the fisherman level the sport fisherman examinations are not in practice.

It is necessary to introduce long life education of fisherman and population of B&H living at rivers and lakes environments and others, not only because of aquaculture, sport and recreational purposes, but also due to coming climate change system changes, and environment protection. Generally it is most important to have higher level of nature, space and



environment protection awareness of entire population. More knowledge always result with less environmental issues problems.

1. 17. Main problems and future development

The future development activities in this field will depend significantly on the new set of environmental laws and regulations, state development plans and supporting institutions for the whole state. Production and protection of autochthons and endemic species and close cooperation with fish farms, will enable mitigation of impacts caused by introduced fish species, and damages caused by illegal over fishing. Introduction of new law for concessions of freshwater resources and law on sport fishing activities (introduced on 5th October 2004) together with education of responsible authorities, would prevent destruction of natural resources, and will help to make importance of integrated freshwater resources sustainable management. National all schooling system levels, lifelong environmental education and awareness campaign would play an important role.

1. 17. Other

Aquaculture

The first records on organized fishing in Bosnia and Herzegovina date from the early Austrian occupation in XIX century. During that time fishing was under the control of Forestry Directorate and the related income consisted of taxes imposed on professional fishermen, so called “fishing fee” (Hutovo blato etc.). Organized protection of water bodies and legal regulations were introduced by Decree in 1886. The first fishermen association in Bosnia and Herzegovina was founded in 1892 or 1893 under the name “Fischerei-Verein fur Bosnien-Herzegovina”. The first sports fishermen association – “Fishermen association” was established in Sarajevo 1906.

Introduction of “modern” fish culture in Bosnia and Herzegovina is associated with the establishment of fish farm “Vrelo Bosne” near Ilidza (Sarajevo) in 1894. In 1898, the new, large hatchery was built, with the capacity of 600 000 pieces of fry. It was the largest and the most modern hatchery in the region. It played major role in the development of trout fish culture and re-stocking of open freshwaters in the country.

Development of cyprinid fish culture in B&H began in 1902 when Polish citizen *Viktor Burda* purchased barren land near Prijedor and Bosanska Gradiska from the Government and constructed a fish farm. He was famous Polish fishery expert and father of *Artur Burda*, our famous fishery expert. Fish farm “Prijedor” became operational in 1905 while “Bosanska Gradiska” started with the production in 1908. According to the available data “Prijedor” fish farm surface area amounted to 300 acres while “Bosanska Gradiska” had 600 acres.

In the period 1946 – 1982, in particular in the last decade of the previous century, a novel, more intensive model of fish and other aquatic organisms culture developed rapidly under the



international name – aquaculture. A system of floating cages at artificial and natural lakes with dense populations and significantly higher production was developed. Fish was fed on highly nutritious palettes.

In the same period herbivorous fish species (Grass Carp, Silver Carp and Bighead Carp) were introduced and produced. Simultaneously, production of trout species achieved full expansion. Companies began constructing fish farms and accompanying objects for the production of trout for consumption. Also, several sports-fishermen associations started producing fish for the market. Thus, fish farming became true economic activity unlike earlier, mainly amateur production of eggs and fry for re-stocking. In 1964 B&H had 13 trout fish farms with the total surface of 3.8 hectares.

Institute for fishery was established in 1952. It became a part of Sarajevo University, Institute of Biology, and was for long time headed by Prof. Dr. *Tonko Soljan*, academician. Institute of Biology encompassed Department of Ichthyology and Fishery, which was run by Prof. *Mahmud Aganovic*, Ph.D. (until his death). *Dorde Kosoric*, B.A. managed Laboratory for Applied Ichthyology. The Institute seniors, Prof. *Tonko Soljan* and Prof. *Tihomir Vukovic*, both academicians, explored the fields of ichthyology and fishery. The Institute of Biology developed extensive scientific activities and is responsible for the development of ichthyology and fishery, in particular trout and cyprinid fish production in B&H.

In 1959 Centre for fishery was established under the umbrella of School of Veterinary Medicine - Institute for scientific and technological cooperation. It played major role in the field of diagnostics, prevention, treatment and management of diseases at controlled trout and cyprinid aquaculture facilities. The Centre manager, Prof. Mithat Cankovic, Ph.D. significantly contributed to its development.

In 1990, B&H produced approximately 3000 tons of fish for consumption. During the war, most of the production capacities were devastated, and a number of workers and experts abandoned aquaculture. After the war, in 1996, aquaculture was re-started. With hard work and dedication by the producers and by re-establishment of interrupted activities result was in “normalization” of aquaculture production. Process of privatization had major impact, and at majority of freshwater fish production sites turned to be rather successful.

In the period 1999 – 2003 overall conditions for production and processing of fish improved (high quality feed, new technology, capacity expansion, establishment of producers association etc.). Good communication among fish producers in B&H was established as well as several business arrangements with foreign investors. The following table illustrates increase in various segments of this field.

Current state in aquaculture for period 1999 - 2002

Total production of fish and shells for consumption	55%
Production of trout eggs	98%
Production of trout fry	69%
Production of trout fish for consumption	82%
Production of cyprinid fry	19%
Production of cyprinid fish for consumption	11%



Production of marine fish and shells	650%
Production per employee	37%
Production capacities	12%
Employment	12%

In this period producers were left to their own inventions and problems. Ministry of Agriculture, Water Management and Forestry introduced stimulation of aquaculture for the first time in 2002. They projected increase of funds and introduced stimulating loan programs. As a consequence of division of the producers according to the entity, legal regulations differences and certain legislation at the level of B&H was obstructed. Problems that require state level legislation were numerous (stimulation of production and export, legislation regarding veterinary requirements for the production and export of fish and fish products, legislation on freshwater and marine fishery, stimulation of employment and capacities expansion, stimulation of the production and conservation of autochthonous species, legislation on water resources conservation, privileges for fish feed import etc.).

As a result of the listed problems only 60 % of the existing capacities are being used. Due to devastation, limited funds and property, privatization process problems, certain fish farms did not begin production. Long term development strategy, good logistics by the state (legal and financial) and registration of all the producers may result in twofold increase in production by coming time. That would represent approximately 10 000 tons of fish and shells for consumption, and 40 million freshwater fish fry for re-stocking. B&H aquaculture products are competitive at the international market, which is additionally verified by the construction of processing facilities. Significant amount of the production of eggs, fry, fish for consumption and autochthonous species are in demand outside of B&H borders. With excellent water resources, production and processing facilities, long tradition and educated employees as well as governments support it is possible to develop this segment of agriculture quite successfully.

Of course we have to mention that the results depends on establishment of aquaculture national system, national legislation, development program, institutional support, financial stimulations, scientific and applied research part, aquaculture professional organisation, education etc., and not last the political development of European Union and co-operation of B&H towards membership with EU.

All this is possible with evolvement of the aquaculture national sustainable freshwater system.

Freshwater fish eggs production 1999-2002 (B&H)

	1999.	2000.	2001.	2002.
1. Eggs				
Salmonid fish – total number	15.675.000	18.571.000	22.462.000	31.024.000
Ciprinid fish	-	-	-	-
T o t a l	15.675.000	18.571.000	22.462.000	31.024.000

Freshwater fingerlings production 1999-2002 (B&H)



	1999.	2000.	2001.	2002.
1. Fingerlings				
Salmonid fish – total number	11.630.000	14.100.000	13.446.000	19.673.000
Ciprinid fish – tons	890	830	781	1.057

Consum fish production 1999-2002 (B&H)

	1999.	2000.	2001.	2002.
1. Konsum fish				
Salmonid fish – tons	1.389	1.785	2.241	2.737
Ciprinid fish – tons	1.807	1.602	1.818	2.009
Sea fish - tons	40	60	70	190
T o t a l	3.236	3.447	4.129	4.936

Production of fingerlings in aquaculture in B&H (1999-2002) considering fish species

#	1999.	2000.	2001.	2002.
1. <i>Oncorhynchus mykiss</i>	9.874.000	11.690.000	11.820.000	16.850.000
2. <i>Salmo trutta m. fario</i>	2.300.000	2.800.000	1.900.000	3.853.000
3. <i>Salvelinus alpinus</i>	1.500	-	-	-
4. <i>Salvelinus fontinalis</i>	200.000	200.000	400.000	570.000
5. <i>Salmothymus obtusirostris oxyr.</i>	-	-	1.200	100.000
6. <i>Thymallus thymallus</i>	-	-	25.000	30.000
7. <i>Cyprinus carpio</i>	560	560	490	709
8. <i>Ctenopharygodon idella</i>	20	10	20	23
9. <i>Hypophthalmichthys molitrix</i>	280	244	255	313
10. <i>Silurus glanis</i>	30	16	16	12

from 1 – 6 total number; 7 – 10 tons

Production of consume fish in aquaculture in B&H (1999-2002) considering fish species (tons)

	1999.	2000.	2001.	2002.
1. <i>Oncorhynchus mykiss</i>	1.339	1.635	2.241	2.765
2. <i>Salmo trutta m. fario</i>	-	-	-	23
3. <i>Salvelinus fontinalis</i>	-	-	-	2
4. <i>Cyprinus carpio</i>	1.455	1.210	1.345	1.510
5. <i>Ctenopharygodon idella</i>	25	30	25	57
6. <i>Hypophthalmichthys molitrix</i>	310	320	415	410
7. <i>Silurus glanis</i>	17	22	33	29
8. <i>Decentrarchus labrax</i>	20	30	35	85
9. <i>Chrysopharys aurata</i>	20	30	35	85
10. <i>Dentex dentex</i>	-	-	-	20

2. Concept of biodiversity applied



2.1. Genetic variability within species

Since 2001 Institute for Genetic Engineering and Biotechnology has been developing research program aimed at genetic characterization and conservation of autochthonous resources. Considering their economic and natural values as well as exploitation models, trout species were identified as priority objects. *Salmo trutta* m. *fario* – brown trout, *Salmo marmoratus* – big-head trout and *Salmothymus obtusirostris* – soft-mouth trout are the first autochthonous species selected for research, considering long-term re-stocking history of their habitats and the expected introgression. In attempt to identify pure wild populations PCR-RFLP of *mtDNA* fragments was applied. Until date they completed study on two isolated populations of *Salmo trutta* m. *fario* (report in preparation – Masters Thesis). The results show high level of integrity preservation in both populations. Currently, the Institute researchers screen STR markers for genetic testing at B&H fish populations of *S. trutta* m. *fario*, *S. marmoratus* and *Salmothymus obtusirostris*.

Joint research team from University of Ljubljana and Faculty of Agriculture in Sarajevo conducted research on *Salmo marmoratus* in Neretva. They were not able to identify pure line in the river where that species was rather abundant some 20 years ago. That information shows the intensity of introgression, probably induced by re-stocking with allochthonous species. University of Ljubljana and Institute for Genetic Engineering and Biotechnology will jointly continue that project and extend it to other trout species.

Genetic testing was, for the first time this year, requested for *Salmo trutta* m. *fario* intended for re-stocking. The Institute for Genetic Engineering conducted testing on three fish farms. The results confirmed longstanding suspicion that fishes are of multiple origin and mainly allochthonous.

2.2. Variability in size/age structure and reproductive quality of the species

At the moment, there are only partial data for some 15% of freshwaters.

2.3. Diversity of species

Species diversity according to taxonomic classification has been stated 1. 2. - 1. 13. The data was compiled according to pre-war records and published as “Biodiversity and biogeography of fish in Bosnia and Herzegovina” (Hadziselimovic & Hamzic, 1999). This issue should receive more attention in the future.

2.4. Diversity of ecosystems

Diversity of ecosystem should be better defined in context of B&H nature conservation legislation. The protection of these values is yet to be incorporated in future Nature Conservation Acts.

3. Major underlining causes of biodiversity decrease



3.1. Over-fishing

Due to the lack of legislation it is not possible at the moment to have reliable data on aquaculture management and fishing. For these reason there are no data on quantity and quality of fishing. Also, due to the current situation in the country some water resources are overused. On the other hand, there are also certain positive examples such is situation in the Una River basin. It is difficult to control actual results and ways of re-stocking.

3.2. By-catch of non-target fishes

Huge damages have been caused to non-target fish species in aquaculture in cyprinid fish farms (3176 ha of water surface). All non-target fish species have been destroyed and thrown away (estimated at 50 tons). In commercial fishing on the Sava River, there are non-reliable data.

3.3. Depletion of local genetically distinct stocks

Introduction of new non-autochthonous fish species often cause damages of ichthyofauna in the most of waterways in the country. This is particularly case with brown trout (*Salmo trutta m. fario*), and there are just a few micro locations where this local species could be found. Several projects on protection of this species have been carried out during last three years at fish farms in Blagaj, Bihac, Prozor and Konjic.

3.4. Physical impact on the habitat

Main physical impacts on the water habitats were caused by intensive construction of hydro-electric-power stations, dams and flood protection facilities on main waterways in the country during second half of the 20th century. This caused significant changes in microclimate conditions and the structure of living communities. The main problems on still water habitats are overload of nutrients leading to the eutrophication, rather than physical conversion of these habitats.

3.5. Persistent contaminants in inland freshwater ecosystem and fishes

After the war, there is no monitoring of the quality of aquatic ecosystems. It is estimated that current situation is much better than it was before the war, mainly since a large part of industrial facilities are out of work. This has been partially confirmed by the results of the toxicological analyses of heavy metals in the lower course of the Neretva River basin. At the moment, there is on-going activities on the analyses of heavy metal contamination in the Neretva River catchments area.

There is also on going Ph. D. study on concentration of heavy metals in the river Bosna carried out at the Veterinary faculty of the Sarajevo University. The results of these studies will provide much better insight in this issue.

Of course the study of impact of synthetic chemicals is overdue, and it is very necessary. Major impact of agriculture is a part of it, as well as pollution during the war.

3.6. Overload of nutrient



Main sources of nutrient overload are agricultural activities, which still heavily rely on application of fertilizers and agrochemicals. Those substances penetrate into groundwater and they often drain into surface waters. Also, lack of wastewater treatment plants in the urban areas and industry causes significant overload of nutrients in all major waterways in the country.

3.7. Spread of diseases

This issue should be considered in legislation at the state level. Also, it would be necessary to force all relevant authorities and subjects to implement the legislation in practice (for more details please see chapter 1.13).

3.8. Other

Since much of watersheds in the country are trans-boundary, it would be very important to start international projects on biodiversity conservation with neighbouring countries. For these reasons it is necessary to mention a very important international project Management of Freshwater Fisheries on Boarding Rivers (2003) for the rivers Sava and Danube, with participation of Croatia, Serbia and Montenegro, and Bosnia and Herzegovina, with support from Norwegian government. Besides these two rivers, similar significant problems are present on the rivers Drina, Una, and Neretva.

4. Driving forces of biodiversity decrease related to inland freshwater fishery

4.1. Increasing demand on recreational fishing possibilities due to transition from commercial to recreational fishing

This trend has started in Bosnia and Herzegovina some four years ago on the rivers Una and Unac, and it was present also on the river Neretva since the year 2002.

4.2. Increasing demand on water and aquatic environments for purposes other than fisheries

There is an increasing trend of use of aquatic environments for recreational purposes on the rivers Una and Neretva. Intensive tourist activities, rafting, and use of motor engine boats on these rivers cause disturbances of fish populations, and pollution of aquatic habitats. Over use of aquatic resources by hydro-electric-power stations is one of the major threats to aquatic environments in the country.

Use of rivers as means for transport of polluted water is an important part of this issue.

4.3. Increasing demand for angling opportunity provided through re-stocking and intensive management of the fishery environments



Although there is an evident demand for angling opportunities in the country, significant problem is lack of united regulation at the state level in this field. There are numerous artificial ponds in the country designed for “put-and-take” fishery.

4.4. Increasing trade, market demand and consumption in freshwater fish and fish products

Fish supply in the country is mainly provided through supermarkets and specialized fish markets. Current consumption of fish and fish products is estimated at 1.5 kg per capita annually. It would be much higher, but due to the very difficult economic situation (high unemployment rate) it probably will not be changed in the near future. There are two factories for production of fish products (Mostar and Banja Luka), but since there is no tradition in use of fish products it would be necessary to pay more attention to marketing of this type of products.

4.5. Increasing illegal trade and movements of freshwater fish

Difficult economic situation and the lack of the implementation of existing legislation have created suitable conditions from the increase of illegal catching of high valuable fish species, in the first place. Since veterinary attest on country level is still waiting to be possible, Bosnia and Herzegovina is not in position to have export of fish, fish products, and other animal products as well.

5. Measures aimed at protecting biodiversity

5.1. Adoption of management objectives in accordance with precautionary approach

Due to the current situation in this field and specific position of Bosnia and Herzegovina, it would be necessary to introduce adaptive management in all neighbouring countries for the most endangered autochthonous fish species. Also, it would be very important to adjust legislation considering this issue in all interested countries in the region.

5.2. Measures to achieve overall reduction in fishing pressure

- Prohibition of fishing of all endemic species,
- Establishment of “closed areas” on some water bodies for certain fish species,
- Size restriction,
- Strict follow up, and statistics of fish catching,
- Education at all levels,
- Establishment of separate department for fisheries at the Ministry of Agriculture, Water-management and Forestry.

5.3. Technical measures with the objective of improving the conservation and sustainable use of inland freshwater fishery resources



It would be necessary to adopt legislation at the state level that would regulate minimal fish size, minimal mesh size, and duration of season for certain species. It would be also necessary to install water treatment at fish farms. Not to mention polluted water treatment of other sources as urban environments, agriculture, industry and transport.

5.4. Measures to reduce fishing impacts on those components of ecosystems which are of little or no commercial importance

United legislation and its implementation in practice are urgently needed.

5.5. Measures to develop basic research to support, inform and advance the integration of biodiversity consideration into fisheries policies

It would be necessary to create suitable conditions for joint research in whole country, and to improve communication and information exchange among major institution, fishermen associations, commercial fisheries and responsible authorities. Also, it would be necessary to establish inspectorate for fishery.

5.6. Measures on habitat restoration and reducing persistent contaminants and excess of nutrients into inland waters

- Implementation of provisions from the Law on waters in practice,
- Construction of waste water treatment plants,
- Implementation of organic agriculture (reduction of nutrient overload).

5.7. Limit introduction of new non-indigenous species to aquatic environments, aquaculture and promote the application of ICES/EIFAC Code

Introduction of non-native fish species is responsibility of the entity ministries, and not at the state level. This creates suitable conditions for illegal introduction of new non-native species. Lack of quarantine at the state level, which should meet standards specified by veterinary authorities, and could prevent introduction of fish diseases in the country. Also, it would be necessary to apply ICES/EIFAC Code, which is not the case at the moment.

6. Management challenges

6.1. Adoption an ecosystem approach to inland fisheries management

Ecosystem approach is the only effective approach in protection and preservation of fish species and their habitats.

6.2. Clear definition and articulation of strategic and operational objectives within a systematic ecosystem based inland fisheries management framework



In order to establish an effective inland fishery management system it would be necessary to carry out inventory of fish species in all major waterways in the country. Also, it would be necessary to create the list of the most dangerous polluters and to prepare list of endangered fish species or the Red Data List on fish fauna of the country.

6.3. Selection and adoption of a practical set of indicators based on agreed objectives, goals and priority setting

This could be defined only after complete inventory of fish and living communities in major waterways.

6.4. Determine research strategies and needs to adapt the ecosystem based approach to inland fisheries management

Support to fundamental and applied scientific research projects, promotion of conservation in the Adriatic Sea basin, expansion of protected area network (only 0.5% of the area of the country at the moment is protected), and environmental lifelong education and raising of the awareness at broader public.

6.5. Previous IUCN activities on sustainable inland freshwater fisheries

There were no any activities on this issue in the country performed by the IUCN.

7. Marketing

Due to before stated problems of Bosnia and Herzegovina socio-political system, actual situation in country and socio-economic system it is difficult to discuss marketing of aquaculture.

There are non-reliable statistical data at any level of Government.

The nature freshwater conditions are very favourable for aquaculture and level of aquaculture production, facilities and management are confirmation of this possibilities.

7.1. Some of the problems involved with fostering of aquaculture in B&H

Political, social and economic system applied at B&H does not allow fostering of aquaculture. Actually it is major break for normal economic development. There are first signs like State Veterinary Administration of this problem solving possibilities. It is important to have Central Government management activities directed toward export possibilities. Mayor issue for export of aquaculture products is veterinary certificate for export purpose. At present it is not possible to have it due to differences between Federation of B&H and Republic of Srpska Governments. It is very difficult situation on one side there are producers of aquaculture products with reasonable technology and even high technology (Norfish at Salakovac) with abundant production and products for exports, and on the other side socio-economic-political system, which does not have adequate abilities.

First step is introduction of new Law on freshwater fishing on 5th October 2004.



Long term policy of B&H to join NATO and European Union is best possibility also for aquaculture activities. With harmonization of country laws and regulations, and socio-economic - political models of EU and B&H majority of organizational, institutional, and socio-economic issues will be improved. But in meantime small steps improvement could be the only answer.

7.2. Present production of freshwater aquaculture

Present production in absolute numbers is unknown, due to differentiation of producers on **registered** and unregistered. The list of registered aquaculture facilities are as follows:

No.	River	Place	Facility	Fish	Remark
1.	Neretva	Blagaj	Norfish	Trout	
2.	Neretva	Konjic	Riba Neretva	Trout	
3.	Neretva	Mostar	Bijela	Trout	
4.	Neretva	Mostar	Pastrmka	Trout	
5.	Neretva	Mostar	Laks	Trout	
6.	Neretva	Jablanica	Prenj	Trout	
7.	Neretva	Jablanica	Ze-ri-ko	Trout	
8.	Neretva	Mostar	Forele	Trout	
9.	Neretva	Jablanica	Sanica	Trout	
10.	Neretva	Jablanica	Eko fish	Trout	
11.	Neretva	Prozor	Dekorativa	Trout	
12.	Neretva	Mostar	Salmon	Trout	
13.	Neretva	Ljubuski	Salmon	Trout	
14.	Vrbas	Bugojno	Akova	Trout	
15.	Una	Bihac	Riz Krajina	Trout	
16.	Bosna	Hadzici	Zunovnica	Trout	
17.		Sarajevo	V. Jovanovic	Trout	
18.		Trebinje	Butreks	Trout	
19.	Vrbas	Crna Rjeka	Tropik	Trout	
20.	Vrbas	Ribnik	Tropik	Trout	
21.	Vrbas	Krupa	Tropik	Trout	
22.		Prijedor	Sanicani	Cyprinid	
23.		Prnjavor	Ribnjak	Cyprinid	
24.		Srbac	Ribnjak Bradaca	Cyprinid	
25.		Bijeljina	Stevic S.	Cyprinid	

(State Veterinary Administration)

In total estimated production during 1999 – 2002 and 2004 estimated production in tons was as follows:

Fish	1999	2000	2001	2002	2004
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Trout	1389	1785	2241	2737	4000
Cyprinid	1807	1602	1818	2009	3000
Total	3196	3387	4059	4786	7000

Unfortunate for aquaculture sector socio-economic, governing and political status is main restriction for fostering production, sales and exports. Detailed analysis of production will be possible to evaluate after enforcement of registration of all aquaculture facilities in the country.

7.3. Markets

There are two main marketing practices: domestic and foreign.

7.3.1. Domestic markets

Fish consumption per capita is estimated at 1.5 kg. The estimates do not include sport fish catch and non registered aquaculture production. The figure could be higher, but lack of statistical data and regular rules for sales recording are main constrains for better quality of numeric figures.

Freshwater fish on domestic markets are sold by offering live fishes at selling ponds or small containers at markets, and secondly by sales at production sites.

There are numerous organizations involved between whole-sales and retail-sales. Usually whole-sales are done on FOB facility basis with average price 4.00 to 6.00 KM/kg for trout. Some of producers offer transport facilities with sophisticated equipment.

Retail price for trout is in average 6.00 to 8.00 KM/kg.

Other prices per kg are:

Carp fingerlings	8.00 KM
Carp consume – retail	4.70 KM
Grass Carp	4.70 KM
Bighead Carp	2.90 KM
Catfish	8.50 KM
Pike-perch	8.20 KM

7.3.2. Foreign markets – exports

At present only foreign markets are Croatia, Serbia & Montenegro, Kosovo, Macedonia and countries of Eastern Europe, with leading position of Russia. There are some exports to Turkey. Exact figures are not known. It is estimates that 60 % of national production has been exports and 40 % are domestic sales.



B&H aquaculture producers have not possibility to export to EU due to lack of central government ability to offer needed activities for certification and documentation for export purposes. With opening of EU export possibility, also organization of production will undergo changes as: certification of producers, introduction of standards (ISO), sales statistics, government income through collection of taxes, etc.

Present data are as follows:

<i>FISH EXPORT FROM BOSNIA AND HERZEGOVINA during 2003</i>		
Goods tariff	Tariff number	Quantity in kg
<i>Oncorhynchus apache i</i> <i>Oncorhynchus chr.</i>	3019110000	5.700,00
... others	3019190000	944.526,00
carp – <i>Cyprinus carpio</i>	3019300000	1.062.402,00
... others	3019919000	507.160,00
... others	3019190000	103,00
carp - <i>Cyprinus carpio</i>	3026911000	725,00
... others	3026968000	1.679,00
... others	3032190000	43.819,00
sole (<i>Solea spp.</i>)	3033300000	312,00
European sardine (<i>Sardina pilchardus</i>)	3037110000	2.685,00
Sprat (<i>Sprattus sprattus</i>)	3037180000	24.824,00
<i>Scomber scombrus</i> and <i>Scomber japonicus</i>	3037430000	8.907,00
argentians hake	3037812000	333.068,00
argentinaans hake	3037812000	107.510,00
Hake - <i>Uroptycis</i>	3037890000	4.563,00
Redfish – <i>Sebastes marinus</i>	3037935000	5.716,00
... others	3037937000	4.857,00
Dentex and pandoras (<i>Dentex dentex</i> , <i>Pagellus</i>)	3037971000	74,00
TOTAL:		3.395.599,00 kg
TOTAL:		3.395,6 tons

<i>FISH EXPORT FROM BOSNIA AND HERZEGOVINA 2004 (I-IX month)</i>		
Goods tariff	Tariff number	Quantity in kg
... others	3019190000	805.776,00
... carp	3019300000	317.566,00
... others	3019919000	180.720,00
	3021180000	315.650,00
... others	3021190000	107.937,00
	3032180000	12.185,00



... others	3032190000	5.187,00
Atlans. losos (<i>Salmo salar</i>)	3032200000	2.081,00
freshwater fish	3032900100	1.100,00
European sardine (<i>Sardina pilchardus</i>)	3037110000	782,00
<i>Scomber scombrus</i> i <i>S. japonicus</i>	3037430000	26.816,00
<i>Scomber australasicus</i>	3037490000	2.310,00
Eel - <i>Anguilla</i> spp.	3037600000	56,00
argentians hake	3037812000	43.852,00
... others	3037819000	45.831,00
Hake - <i>Urophycis</i>	3037890000	4.355,00
Redfish <i>Sebastes marinus</i>	3037935000	1.306,00
... others	3037937000	3.958,00
Dentex and pandoras (<i>Dentex dentex</i> , <i>Pagellus</i>)	3037971000	536,00
... others	3037998000	121,00
TOTAL:		1.878.125,00 kg
TOTAL:		1.878,1 tons

Bosnia and Herzegovina for the moment have only a few aquaculture farms having equipment/facilities sufficient to be recognised for export of eviscerated fish to the European market. In order to be able to export fishery products authorised for human consumption Bosnia and Herzegovina has to be listed as a country for potential export of fish according to EU Commission Decision 97/296/EC with later amendments.

Of the 50 Aquaculture farms in B&H several small producers wish to export live Rainbow Trout into neighbouring countries. In order to be accepted for export of live fish surveillance within the epidemiological zones has to be done for every farm minimum twice a year, and analysed at an accredited laboratory for viral investigation of fish diseases (IHN/VHS). Given that no positive samples has occurred in one epidemiological zone during two consecutive years intensive surveillance according to EU Commission decision 2001/183, export of live trout might be possible.

Because it is urgent to have some of the establishments listed for export, official surveillance in aquaculture partly has to be incorporated in the budgets for the two years program. Gradually the entities must take the responsibility for these running expenses.



To make it possible for fish processing establishments and aquaculture farms to apply in order to get export license to the EU Market, at beginning for products of fish, and later also for live fish export.

Export of eviscerated frozen fish, mainly trout approximately 2000 tons of trout and 2000 tons of live carps each year, and additionally 200 tons of live seawater fish. Increasing gradually as export will be extended to include live fish of trout and potential expanding the domestic aquaculture production into 10 - 15 thousand tones annually in the future. A successful implementation of inspection and reporting in aquaculture sector will provide a model also for surveillance in veterinary inspections in the animal husbandry.

Training, education and technical equipment for inspectors are needed. Also it is necessary to upgrade laboratory facilities, equipment, and additional training of laboratory specialist for international fish laboratories protocols. During initial phase the preliminary subsidy for inspections are needed, and it would be necessary to use the international instructors for the laboratories at local and country levels.

Bosnia and Herzegovina at present is not listed among countries for export to EU for any product of animal origin (except frog-legs, and snails). The state veterinary office has pointed out aquaculture as a pilot project of getting license for a few establishments. A success in this limited area will give a positive signal and create optimism in other sectors of animal husbandry production.

As we are expecting on spot evaluation from the EU inspectors during the next year, we must start increased surveillance at once.

As mentioned above the catalytically effect will be to create optimism in aquaculture industry and also in the establishments for production of products of animal origin.

This project idea/proposal is based on an independent technical evaluation of a Perceived need made on the basis of experience/knowledge of the country. Getting export license for aquaculture products is of high priority for the State Veterinary Office. B&H has no serious disease outbreaks in aquaculture and there is the obligation to provide the necessary framework in order to make export a reality.

7.3.3. Foreign markets – imports

Main import item is fish food. From April 2004 3.141.000 kg of fish food import permits were issued, but the quantity of imported food is not known. It is result of poor statistical data collection, which is due to not well organized functions of central Government. With better organization of central government, better possibilities for statistical data will be available.



<i>FISH IMPORT IN BOSNIA AND HERZEGOVINA IN 2003</i>		
<i>Goods tariff</i>	<i>Tariff number</i>	<i>Quantity in kg</i>
<i>Live fish</i>	301	1.345.300,00
<i>Fish, fresh and cold</i>	302	25.418,00
<i>Frozen fish</i>	303	5.377.382,00
Fish filet and other meet	304	461.665,00
Fish, dried, salted, and marinated	305	10.552,00
TOTAL:		7.220.317,00 kg
TOTAL:		7.220,3 tons

<i>FISH IMPORT IN BOSNIA AND HERZEGOVINA 2004 (I-IX month)</i>		
<i>Goods tariff</i>	<i>Tariff number</i>	<i>Quantity in kg</i>
<i>Live fish</i>	301	712.276,00
<i>Fish, fresh and cold</i>	302	27.620,00
<i>Frozen fish</i>	303	2.983.824,00
Fish filet and other meet	304	396.629,00
Fish, dried, salted, and marinated	305	2.954,00
TOTAL:		4.123.303,00 kg
TOTAL:		4.123,3 tons

<i>IMPORT OF FISH FOOD IN BOSNIA AND HERZEGOVINA IN 2003</i>		
<i>Goods tariff</i>	<i>Tariff number</i>	<i>Quantity in kg</i>
<i>Fish food</i>	23099010000	3.192.597,00 kg
<i>Fish food</i>	23099010000	3.192,6 tons

<i>IMPORT OF FISH FOOD IN BOSNIA AND HERZEGOVINA 2004 (I-IX month)</i>		
<i>Goods tariff</i>	<i>Tariff number</i>	<i>Quantity in kg</i>
<i>Fish food, kg</i>	23099010000	
<i>Fish food, tons</i>	23099010000	

Source of above data on export and import of fish and fish food in Bosnia and Herzegovina is – Foreign Trade Chamber of Bosnia and Herzegovina.

Sum Of quantity (kg)	Sum Of amount (BAM)
386.760,00	475.332,32
22.005,00	46.103,23
886,00	55.634,24



	860.939,00		1.619.399,92
	118,340,00		205.903,55
	39.857,00		37.306,86
	48.000,00		26.423,89
	1.007.318,00		1.574.204,86
	42.180,00		12.388,34
	437.810,00		773.341,37
	15.971,00		53.234,32
	1.798.585,00		1.480.167,62
Sum Of Sum Of Quantity:	4.778.631,00	Sum Of Amount:	6.359.440,52

Licences approved for requested amounts of fish food for import from certain companies by State Veterinary Administration of Bosnia and Herzegovina for period I-IX month of the year 2004.

Planned import of fish food from countries: Austria, Belgium, Germany, Denmark, France, Croatia, Hungary, Italy, Latvia, Holland, Slovenia, Serbia and Montenegro.

Data from Foreign Trade Chamber of Bosnia and Herzegovina and State Veterinary Administration of Bosnia and Herzegovina are not completed, and therefore, it is not possible to carry out more detailed analysis of import and export of fish and fish food. It is difficult to analyse on the basis of obtained data species of fish that are locally produced that are exported (destination and quantity). The same is with fish food since we do not have any data on type of food, origin and importer.

Main problem in B&H represents lack of common data in aquaculture (capacities, amount of produced fish, number of employees, type of fish food, and number of fish farms, etc.). For these reasons responsible ministries in both entities do not have complete documentation in this field, and at the state level the situation is even worse.

There are serious predictions that B&H in the year 2005 could get Ministry for Agriculture, Water Management and Forestry at the state level. This could enable passing the law in the field of fishery and aquaculture at the state level, and in the same time coordination and monitoring of the problems in the fields of aquaculture at one much higher quality level.

7.3.4. Additional marketing and markets

Due to number of exceptional nature beauty rivers and water environments in Bosnia and Herzegovina there are good opportunities for additional production and marketing as well as markets for following:

- Production, sales, imports and exports of interested fish species eggs, and
- Production, sales, imports and exports of interested fish species fingerlings.

Additional production, sales, marketing and markets could be developed due to need for re-stocking of natural waters. With sophistication of the aquaculture in future it will be possible to



export interested fish species eggs, fingerlings etc., under condition of co-operation of science and applicative research work, government institutions, sport fishing sector, aquaculture management, environmental protection and population social-economic sustainable future and good work.

Production and sales of fingerlings of brown trout for re-stocking of natural waters is already in practice. But market is still under development, and many additional systems should be introduced, to develop domestic re-stocking and export possibilities.

Conclusion

Natural resources of B&H are abundant, and main constrains for fostering production and sales of freshwater aquaculture products could be concluded as:

- Organization of freshwater aquaculture production and sales on country level should be equal to all citizens/organizations and companies,
- Organization of central government and establishment of adequate laws and regulations for the sector,
- Organization of environment, space and nature protection of country system,
- Co-operation of scientific and applied research sector,
- Organization of sport fisherman associations and their protective activities for preservation of freshwaters and fishes, and according to in October 2004 published Law on Sport Fisheries,
- Effective process of privatization – concession and management practice for open waters,
- Establishment of long range plan for development of the aquaculture and freshwater fisheries sector,
- Incorporation of aquaculture and freshwater fisheries activities within socio – economic – politic system of the country, and etc.

We would like to conclude this presentation with wish for sustainable future of aquaculture, fisheries, sport and recreation of freshwater environments of B&H.

3.

CORPORATE SOCIAL RESPONSIBILITY AND SCIENCE – THE INFORMATION THEORY OF NATURE

By

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**Abstract**

Corporate social responsibility and the modern linking of economic and ecological viewpoints of the human life under the name of sustainable development share an important attribute: they both consider human influence over nature, including human life, and they both see the need for more holism of consideration than the practice of recent decades and centuries has demonstrated. That's is why we suggest cybernetics and systems theory to be applied, especially the Dialectical Systems Theory, and a new Information Theory of Nature to be developed for the human action to have a requisitely holistic basis.

Key words: corporate social responsibility, cybernetics, Dialectical Systems Theory, Information Theory of Nature, Sustainable Development, Systems Theory



The selected problem and our viewpoint of dealing with it here

Corporate social responsibility is by definition different from social responsibility as a macro economic and sociological term (Buchinger, 2004; Knez-Riedl, Mulej, Dyck, forthcoming). Although business systems, including corporations, are supposed to consider their own interests only, their self-interest is not supposed to be too narrowly defined, even in terms of the concept of “the invisible hand of market and profit” which sees the interdependence of the seller and the buyer in the market rather than their (economic) independence (Petzinger, 2000), although many business persons do not want to read it that broadly. It is their behavior, which requires the issue of the corporate social responsibility to be raised. In the case of nature, the term the “sustainable development” means the care for nature and the care for economy are two interdependent parts of the same story (Ecimovic, Mulej, Mayur, 2002). Interlinking the two cares requires a rather broad concept of information as the basis for care, insight, thinking, decision-making, and action. The traditional information theories do not seem to go that far. Hence, we feel that there is a need for a new one – an information theory of nature.

Definition of the corporate social responsibility

Let us take this definition from (Knez, Mulej, and Dyck, forthcoming): The concept of the corporate social responsibility is not a very new concept. But the era of globalization and the so called new economy put additional demands: companies should comprehend all the different problems of their employees and their partners in their social and business environments as well as to work with them in solving broader societal problems, including producing and implementing innovative ideas in order to make a contribution to a higher quality of life of the community they belong to, too. Their business behavior is aimed at meeting the needs, attaining revenues and profits, creating jobs, and investing in the future development of the company and of its soci(et)al and business environments alike. Thus, the definition of the corporate social responsibility addresses linking of the societal, social, economic, and business viewpoints in a dialectical system in the daily operation of a corporation (or any other organization, for that matter), and doing so on a free-will basis. The concept is being put on stage anew by the European Union Documents such as “Green paper on Promoting a European Framework for Corporate Social Responsibility” (COM 2001, 366) and the “EU Strategy for Sustainable Development”, launched in 2001. From the viewpoint of the firm, working along these lines provides several economic benefits, such as a better image, larger sales, bigger customer loyalty, etc. (see: <http://www.bsr.rg>).³

³ For details and application to small and medium sized companies in Slovenia see: Knez-Riedl (2002). For links with the care for environment see e.g.: Ecimovic, Mulej, Mayor (2002); Karner, S., Oehme, I., Seebacker, U., eds. (2003); Potocan, Mulej, 2003. For links with corporate governance see e.g. Rozman and Kovac, eds (2003), especially: Potocan and Kajzer (2003); Udovicic (2004); Markic (2003). For the role of the corporate culture see e.g. Treven (2000). For an insight how poorly is it included in measurement and assessment of corporate success see e.g. Buble et al (2003); Germ Galic (2003). For links with trust see e.g. Rozman and Kovac, eds (2004).



This definition lets us feel that the corporate social responsibility requires humans to think, decide, and act on a very broad basis rather than to reduce their horizons to the narrow habit of businesses to find profit only essential. The too narrowly defined profit (as the motivation) kills profit (as the outcome) by causing too many oversights and hence many troubles and costs, which could be avoided with less of the exaggerated reductionism (Dyck, Mulej, 1998; Ecimovic, Mulej, Mayur, 2002; Knez-Riedl, 2000; etc.). Thus, the need for a lot of holism says that both cybernetics and systems theory may apply to corporate social responsibility (See also: Jackson, 2003; Scott, 2002). Why?

It is very unusual!

Life, even survival of us, the modern civilization, depends completely on conditions provided by the *nature and biosphere* in which we all live.

The Universe, Nature, Sun, Earth, Biosphere, climate and climate change system, terrestrial/water/air environments are *no simple systems* (features, entities, and processes), but complex and complicated.

We humans live on Earth, which is a *small, but integral part of the Universe*. We are able to live here due to suitable climate and other living conditions. All over the billions of years of the existence of our planet Earth, the living conditions have kept changing. The impacts causing this changing, in general, result from natural processes and/or human interventions. Both kinds of impacts can cause consequences, which are both good and bad by human criteria. E.g. from a rather one-sided/narrow/shallow/oversimplifying viewpoint the changes in the human life over the last 2 – 3 centuries are bringing the so called *progress*: more comfort, a higher standard of living on the basis of the many technological and non-technological innovations. But from a more holistic/broader/systemic/complexity-facing viewpoint we see that the same changes tend to cause our own *extinction*. Which is the *correct viewpoint*? The usual answer would read: the common sense. But the modern experience demonstrates very many destructive consequences of the “common” sense (nuclear technologies, synthetic chemical research and production, genetic engineering, the climate change system, the only God in 21st century - The Money, Corporate social responsibility with no definition, etc.), i.e. the *one-sided viewpoint* as a usual basis of thinking, decisions making and acting, which is normal with all of us individuals as specialists knowing a small fragment of reality. So, at least since the UN (humankind’s highest political body) has planned for “*sustainable* (i.e. no short-term and nature-destroying) *development*”, the humankind of today knows: we should better apply the “uncommon” sense, i.e. the holistic/systemic thinking. Each and every individual human idea, decision, and action may seem to make a small, even negligible impact, but the consequences of all of them together may be tremendous.

In the case of our biosphere, our human actions tend to cause our own *self-destruction*, because we tend to *lack holism*, both in our knowledge, values, emotions, and resulting actions.



It is hard to believe what we, as humankind, know about the world and the universe. Many well-known issues and insights, however, are fragments of the whole, and we have to understand the whole on the basis of fragments without knowing the whole. And what is the whole, where are limits of fragments, and what are issues of a whole? We think *the whole is everything*, and all other features are issues within/without inferior and superior systems/wholes/entities making partial or (fictitiously) absolute whole/s.

We think the *absolute/only/total whole* is what we humans call the *Universe*⁴.

Now, how to understand our own role as humans within the Universe, when our understanding of the nature, space, environment is evolving/innovated from and by fragments, which have never been put together to allow for a holistic insight?

The natural evolvement, which has only one direction – *the dynamic multidimensional evolvement ahead*, does not include its own payment system, profit, financial institutions, corporate social responsibility, and all other innovations of great importance for our civilization of today. The nature has its own absolute knowledge, energy, matter, ability and possibility to construct systems/entities according to the existing information, matter, energies, powers, particles, rays etc. of its own. The question is “Why is there a planetary system like the Solar System?” and the answer could be “We do not know, but we think that it is a result of the interdependences, interaction and co-operation of environment, information, energy, matter, powers, particles, rays etc. at the moment of transformation/formation”.

What is certain, hence, is that the time has come for our civilization to make a decision about our future, including our own very near future. That decision, we believe, will take us forward to a sustainable future, if a requisitely holistic thinking comes to *complement* the usual narrow specialists’ thinking. It should help us see that we are not independent, but *interdependent*, i.e. needing each other and needed by each other. We all live on the same planet Earth/Biosphere, which we cannot misuse forever.

Black/white, shallow/deep, good/bad, positive/negative, primitive/civilized, and many more coupled terms could be put together and enable us humans to see the origin of interdependences, interactions and co-operation of the Nature, and natural systems. What was there first: “hen or egg”, “innovation or routine”, “information or matter and energy”? The answer is obvious, but rarely taken into account: they are interdependent, as soon as we consider the natural dynamics, not only a moment (which does not exist on its own anyway). So are specialized professionals, needing *creative interdisciplinary co-operation* as their/our shared way out of the blind alley of a too narrow insight, thinking, decision-making, and action.

People, with their values, emotions, and knowledge, have been making an epic song of our civilization, which has been going on since humans have existed. And so has other parts of the Nature, and natural/biosphere systems. We people are a part of nature, although this has been admitted less over the last three centuries than ever before.

⁴ Universe as seen at present is a small part of the Universe as whole, according to data of astronomy.



Since we (our civilization) have lost touch with our origin, it was not lost connection, but we commenced building our own image. Today the urban human / Homo sapiens urbanus is an anthropocentric/egocentric representative of humans, with new ethics (for third millennium) that recognize only one God – money. The rest of civilization/s – peoples of rural areas, mountains, small islands, jungles, arctic regions, semi and other deserts – make a minority without all “human rights” in practice, due to pressure from bureaucracy, and only to bureaucracy understanding countless forms and paths for ruling by power of not producing but ruling. During feudalism and before it humans used to live from nature, and as part of it. It was easy to manage kings and noble people due to their small number, but today our civilization has less and less of the producing population and more and more of the bureaucratic supported families.

Tribe, chief and spiritual leader were primary civilization achievement for protection of Homo sapiens during Neolithic time. Second to that was their innovation/development of religion, as the ruling practice making a self-appointed minority of people/individuals making their living at the account of majority/other people? Taking care of souls by stories and tales brought Kingdoms and slavery, as practiced in antiquity. What is it all about? We think society is a result of our origin as social creatures, or it is a way for survival – making living – having reproduction, food, shelter, and cloths. Someone may say it is confusion/chaos or something, but we think, it is based on something, which is not matter and energy only, but information as a third, invisible impact. Thus, we have to develop an information theory of nature. And: if we have to develop the Information Theory of Nature, we have to understand the beginning of our civilization.

A basic set up of Homo sapiens – from the current level of understanding – is family. Actually we think it is male/man and female/woman of our species Homo sapiens as one/individual representative, with a countless number of possibilities to make society. Development was interconnected with interdependences, interaction and co-operation of all matter, energy, powers, particles, rays, and information in evolvement, and within smallest/small/large/larger/biosphere environment. The process’s result is the present status of species within biosphere (six billions of individual representatives at the end of the second millennium).

Why are we making such a statement? – We want to show relationship between The Nature and our civilization, as basic path for understanding the nature by the Information Theory of Nature.

What is the Information Theory of Nature? A first Attempt of its Definition



There is no beginning, and no end, but it is LIFE or the Nature as a whole, or as a requisitely holistic unit inside it – the planet Earth. Within the Earth there are all known and unknown forms of nature. With evolvement of Homo sapiens' civilization – from 120.000 – 16.000 years onwards, each and every human may change evolvement of the society. As case study supportive of our statement, one could take “achievements by” Napoleon, the French emperor, who had a major impact over the present society with his great wars. Similar could be seen from the other history of humankind – Confucius, Gautama Buddha, Christ, Alexander The Great Macedonian, the Roman Gaius Julius Caesar, the Polish Copernicus, the English Newton, Darwin, the French Napoleon, Robespierre, the German Adolf Hitler, to mention some of influential humans from past, and Stephen Hawking, till today the greatest scientist of our time. What we are trying to say is – our civilization has taken right to interpret The Nature. In such a way we have at least a double interpretation of the Nature – first: The Nature is as it is; and second is The Nature as seen by our civilization.

On this basis, in the first case, the information is a force causing e.g. a cell of a conceived baby to evolve into its eye, and another cell to evolve into its right hand, etc. In the second case, the information is the basis for humans to understand the nature, including them-selves, and to influence it.

In other words: The Information Theory of Nature is briefly expressed as follows:

$M \text{ (matter)} \times E \text{ (energy)} \times I \text{ (information)} + T \text{ (time/evolvement)} = \text{The Nature/LIFE}$

The equation has to be put into environment (in our case) – The Universe, The Earth/The Biosphere of The Earth, where basic relations are evolvements of the systems of the Earth Nature as interdependences, interactions and co-operations of all of them – matter, energy, information, particles, powers, rays, etc.

The traditional Information Theory has been innovated and to become seen as a basic quality of The Nature with its matter, energy, and information, having the information as an integral part of The Nature along with matter and energy, and evolvement of matter and energy is inter-connected with evolvement of information. All this should be seen within an environment.

The Information Theory of Nature is based on system theory/thinking and its implementation, as a contribution toward a better understanding of The Nature by our civilization. The Information should not be interpreted as information by the superficial human standards (Webster's or any dictionary, etc.), or by information theory as processes of communications and the transmission of messages, or by information science – collection, storage and retrieval of information, and or by any other use of the word information in the present practice (end of 2004).

The Information within The Information Theory of Nature, which we are dealing with in this contribution, includes the following statements:

- Information is an integral part of Nature along with matter and energy,
- Information as an integral part of Nature with its matter and energy is evolving as well as matter and energy are,



- Information, matter and energy do not exist, if they are not an integral part of the Nature as a system/environment,
- Information, energy and matter are evolving within the interdependences/interactions and co-operations of all levels of systems within the Nature and its environment, and are making evolution of the Nature,
- Information, energy and matter could evolve into a countless number of cases, depending on environment, systems and interdependences, interactions and co-operation within the Nature and its environment,
- Information is the ability of matter and energy, of the Nature is reduced to them only, or of any part of its environment, which enables countless forms, countless environments of – in our case – the Earth and the biosphere, which is one of cases.

The information as a part of Nature and therefore an essential part of The Information Theory of Nature creates the attributes/quality of environment, matter, energy, any particles, rays or any form of matter, energy or natural powers. The Information Theory of Nature is a theoretical approach to basic problems of present understanding of the Nature, and looks like a missing part, which has to make a requisitely holistic presentation of requisitely holistic part of the nature.

The Information Theory of Nature sees information as an integral part of the nature and it requires system thinking for understanding of all interdependences, interactions and co-operation. Since the information theory has to do with influencing, it has to do with cybernetics, too.

Briefly about Cybernetics

In 1943 the first articles were published on the idea of transferring knowledge from biology to engineering aimed to invent and produce machines capable of imitating human mental activities, some of them at least. Cybernetics was originally created on an interdisciplinary basis: they were trying to make a synergy of knowledge of biology and technology to produce novelties, supposed (and frequently able) to become even innovations (= novelties found beneficial / useful and used by their users / consumers). They were using the word system to denote that they were dealing with a complex and complicated feature as a whole rather than one-sidedly. (See: Umpleby, Vallée, in Mulej et al. 2000, p. 334.)

In 1970, on the basis of a contribution by H. von Foerster, the distinction between *the 1st and 2nd order cybernetics* was introduced. The first one was concentrating on the observed object, the second one on the observer and observing as a mutual impact between the observer and the object of observation. This was a revolution in science, because the supposition of a total objectivity of science was given up and replaced with a more realistic one that includes the influential role of the observer. The quite logical next step is an attempt to impact the impacting person, which made room for Umpleby's *cybernetics of conceptual systems*: there is a mutual impact between the ideas and the society, and the cognition is at the same time a biological and a social feature. Cybernetics has no longer to do only with understanding biology and mastering machines on its basis, including automata, but also with thinking of humans, including specifics of individuals rather than observers in general only. (See: ibidem, pp. 344-349)



Another line of development of cybernetics is much older than the 2nd order cybernetics of 1970. Initially it reaches in 1951 and the work by R. Vallée. Its modern point is aimed at an explicit synthesis of observation, decision-making and impacting, stressing especially the phase / activity of decision-making. This is the basis for the notion of the 3rd order cybernetics and *epistemo-praxiology*. (See: ibidem, pp. 353-364)

Sociocybernetics went another step further to bring cybernetic and systemic thinking in topics concerning society at large, which is very complex, whatever is the entity investigated (Geyer, Hornung, eds., 2003; Misheva et al, ed., 2004; Journal of Sociocybernetics).

Cybernetics, hence, introduced complexity⁵ to science, not complicatedness alone any more, by attracting attention to relations, impacts, hence information, which opened human insight into the previously overseen attributes of reality. It helps humans control their own conditions of life a lot more efficiently and, hopefully, more holistically, too. Complicatedness has been and is a topic of the traditional sciences, while complexity has been and is tackled by systems theory and cybernetics.

On such a basis one may conclude and define: Cybernetics is a science and practice of influencing / controlling / managing features, events, and processes that make a dialectical system as follows; they:

Are complex or very complex, i.e. have multiple relations, internally and externally;

Are open, i.e. have relations with their environments, especially interdependencies, including the ones between different viewpoints of consideration of the same reality;

Are dynamic, i.e. able to change, including the observers, decision-makers, and impacting actors;

Take inputs as well as produce outputs – impacts by information rather than by material/energy flows only;

Support, stabilize, and simplify these flows by feedback loops;

Are mentally, explicitly or implicitly modeled from the selected (set or system of) viewpoint/s.

Cybernetics cannot be reduced to feedback loops alone neither to modeling alone, but it rather takes all six attributes mentioned as one synergetic whole. Thus, cybernetics is one of many specialized disciplines on methodology of thinking and action that (1) are needed when dealing with the corporate social responsibility as a complex process, and (2) need to be requisitely holistic, and can hardly be so, very often, if left alone rather than acting in interdisciplinary cooperation with other specialized disciplines. – Here, systems thinking becomes necessary to cybernetics, and therefore also to the dealing with the corporate social responsibility. The latter is a process that has to do with relations between parts of society and meets all six criteria briefed above (as a dialectical system, of course).

Briefly about the (General) Systems Theory and Systems Thinking

⁵ Complexity covers entanglement resulting from relations among parts of the entity under consideration, while complicatedness cover the one resulting from attributed of individual parts alone. (See: Schiemenz, in Mulej et al, 2000, p. 405-411)



At about the same time as the initial authors of cybernetics, another group with L. v. Bertalanffy (LvB) was working on a new worldview called the General Systems Teaching / Theory (and related methodology supportive of making it happen). One of his crucial sentences says that humankind has a poor chance to survive if we do not think and behave as citizens of the world rather than single countries, and if we do not consider the entire biosphere as one whole. For this reason it is necessary to supplement and/or fight the modern exaggerated (!) specialization, obviously by inter-disciplinarity and isomorphisms – since there seems to be no other way toward survival (See: Bertalanffy 1979, p. VII and later; Davidson 1983; Elohim 1999; Dyck, Mulej et al. 1998; Ecimovic et al. 2002; Mulej et al., 2004).

Hence, the LvB's point lies in holism, not in formal description of an entity as a system.

We can also conclude from LvB's and other writings as well as from the real life experience that a system is a mental picture of the object. This mental picture is made by the author / observer / manager of this object from his / her selected viewpoint/s in order to let the attributes of the object that he / she finds the most important ones, be clearly visible, exposed. Thus, the system is not really equal to the object it represents, and the model represents the system (because the system is limited in one's mental capacity and interest compared to reality with all (!) attributes). Due to this mental capacity, limited for natural reasons ("bounded rationality"), we humans try to control / manage / create the world although we have a very *limited insight* into its reality; to overcome this natural lack of capacity, we need *interdisciplinary creative cooperation of specialists who are mutually different and hence complementary and willing to co-operate*.

But today, systems theory disintegrates and/or develops into a number of them (see: Mulej et al., 2003a; Mulej, Potocan, 2004, for details):

The ones putting system equal to object, which is OK in theoretical mathematics only, but fictitiously holistic in LvB's sense, in other cases: the view is reduced to one single viewpoint / profession / scientific discipline alone;

The ones defining system as a mental picture of the object, thus admitting their own specialization, unavoidable lack of holism, but not admitting the resulting need for interdisciplinary creative cooperation hence working on complicatedness rather than complexity, inside their own specialties;

The ones defining system as a mental picture of the object, thus admitting their own specialization, too, and interested in inter-disciplinarity;

The ones working on systems theory as a generalization of attributes of systems as complex features;

The ones working on systems theory as a theory of holistic thinking rather than mathematically.

They are all legitimate, of course, but very different. What is going on, hence?



The word system was introduced into the Systems Theory and Cybernetics in order to denote the intention to refuse one-sidedness and support holism of consideration, but with no exact and unified definition of what holism means (See e.g.: Turina, Tintor 2003; Zupan 2003; Bausch, Christakis, eds, 2003; Geyer, Hornung, eds, 2003; Trappl, ed 2002; Rebernik, Mulej, eds, 2002; Rebernik, Mulej, Kroslin, eds, 2004; Rosi, 2004; etc.). The Bertalanffian worldwide holism requires too much breadth from specialists, especially from the ones with no or a poor training / practice in interdisciplinary creative cooperation. On the other hand, in a Webster's dictionary the word system has sixteen groups of meaning. (Webster 1987) A closer look tells us that all of them have two attributes in common:

In contents a system always represents a selection of the object's attributes from the author's selected viewpoint, and never the object as a whole.

In the mathematical, very abstract and exact, formality a system is always a round-off entity, a whole, made of elements / components and of their mutual relations, as well as of the relations with its environment.

Thus, a system is holistic, mathematically, and one-sided, in terms of its contents, at the same time. From several viewpoints, several systems, all with different selections of attributes, and hence of contents, can be introduced and let us see the same (!) object under consideration differently; therefore, we can use the same language, but differ in observations, decisions, and actions.

Obviously, there is a crucial need for a system (in mathematical terms, network) of systems (in terms of their contents, requisitely holistic mental pictures) for observations, decisions, and actions to be requisitely holistic and thus requisitely reliable. But: not all kinds of systems theories provide the theoretical basis for such an orientation of systems thinking⁶. The Dialectical Systems Theory (Mulej et al. 2000, and earlier, since 1974) does. Hence, it may be an appropriate selection when dealing with the corporate social responsibility, like it has been in dealing with economics, sports, organization, business analysis, innovation and creation of socio-economic and organizational preconditions for innovation, creditworthiness assessment, quality efforts, etc.

Briefly About the Dialectical Systems Theory

⁶ We must never forget that systems theory has been introduced to fight the exaggerated narrow specialization after the end of the period of two World Wars and a worldwide economic crisis of 1914-1945. We must neither forget that systems thinking, as a practice of a requisitely holistic thinking has been around forever, as an intuitive basis of success, and expressed in e.g. Yin&Yang of the Ancient China, and in dialectics, i.e. the philosophy of interdependence, of the Ancient Greeks (Delgado, Banathy 1993), as the basic ancient forms of informal systems thinking. Only a few systems theories try to cover this today.



From 1974 on, one can trace the evolution of the Dialectical Systems Theory (DST) by M. Mulej. He was dissatisfied with authors forgetting about inter-disciplinarity, as a way closer to the presupposed holism, in contributions about Cybernetics and the General Systems Theory (see: many proceedings of systems theory and cybernetics conferences, too many to quote here, except the “Problems of ..”, “STIQE”, “IDIMT”, but they all came later). Thus, he coined the notion of the “Dialectical System” and then the “DST” (Mulej, 1974; Mulej, 1976; Mulej, 1979; Mulej et al., 1992; Mulej et al., 2000; Mulej, Zenko, 2004; etc.). By definition, the Dialectical System is a system (in mathematical terms) of systems (in terms of their contents), including all essential and only essential viewpoints and therefore systems featuring parts of the same object. They are mutually complementary, therefore interdependent, or in the ancient Greek word, dialectical. To make this notion workable, Mulej created the DST as a methodology of thinking (in observing, decision-making, and impacting) based on the following findings about reality:

Humans think, and they do so on the basis of their *subjective starting points* (mentality, emotions, perception of the objective reality), which *can be influenced*.

The starting points, especially the subjective ones (which select, by observation, the attributes of the objective, i.e. outer reality to be taken in account), *influence all the further process* of definition of objectives and their attainment, in which many features and attributes are interdependent, rather than simply linearly dependent.

The starting points can be influenced, too, e.g. by education and other information processes, especially the subjective ones. But the receivers of those influences tend to *react* to them *differently*, if their role is to define objectives, or to attain objectives by partial tasks to be done.

In acting according to their roles, humans try to be rather holistic, in order to avoid failures and the resulting troubles. But they tend to define *holism* rather *differently*.

It is impossible for humans to be *totally holistic* on the level of LvB’s requirements, but it is an unfortunate other extreme, if one defines one’s own holism *very narrowly*, e.g. inside one single specialization, thus producing a *fictitious* holism rather than a *realistic* one; perhaps one even imagines that a realistic one has been attained, anyway (which is even worse).

These are reflected in Mulej’s DST as follows (Mulej, Zenko, 2004a; etc.):

1. *The law of hierarchy of the following order (succession) and interdependence.* It is not the structure of subordination, but the processes that make results, and it is cooperation, which makes processes happen. Therefore, one must start with the starting points, making the basis for definition of objectives, not merely with objectives having no foundation except in one’s wishes.
2. *The law of entropy.* There is a permanent natural tendency of everything existing to change into something else, to be destroyed, and to help create something else, both at the same time. It is entropy, which requires humans and other beings to be requisitely holistic and creative rather than one-sided and routinized.
3. *The law of the requisite holism.* There is a permanent need for a dialectical system, once a one-sided system is not holistic enough, and a total – Bertalanffian – one cannot be attained. The decision makers must take responsibility for their selection of what enters the dialectical system, and what is left out (but does not stop existing and influencing, once it is forgotten about, in reality).



4. *The (incidentally ten) guidelines on how to form the subjective starting points of persons active before the definition of objectives* in order to support the requisite holism and creative in this phase of the work process. These persons must be rather broad and synthesis-oriented, being the bosses, heads, CEOs.
5. *The (incidentally ten) guidelines on how to form the subjective starting points of persons active after the definition of objectives* in order to support the requisite holism and creativity in this phase of the work process. They must be rather deep and hence narrowly specialized, analysis-oriented, being responsible for single details, but still understand and support a broader definition of the requisite holism.
6. *The USOMID*, DTS-based applied methodology of creative cooperation, enabling participants of the work process to consider and use all the three laws and both dialectical systems of guidelines, with no single word of their theoretical background.⁷ The experience with deployment of the DST in non-academic settings soon demonstrated the need for those rather philosophical concepts to be expressed in an organizational technology, i.e. methodology. This is why USOMID came about; the acronym reads: Creative Co-operation of Many for an Innovating Work (Mulej et al., 1986).

On such a basis, in Mulej's Dialectical Systems Theory, holism tends to be both as close to the definition of holism found in LvB and workable as requisite, and therefore to be a dialectical system of four interdependent attributes:

Systemics (attributes of the whole, but not of its single components), complexity, synergies.

Systematics (attributes of the single components, but not of the whole), complicatedness, details.

Dialectics (attributes of relations making the whole's attributes by causing emergence, resulting in synergy), interdependence and resulting interaction.

Materialistics (attributes of the observer, decision maker, and/or actor, called also realism), the smallest possible deviation from reality.

Briefly about the Natural Systems

If we try to talk about an information theory of nature, we have to add here some thoughts and facts about the natural systems. These systems (as complex entities rather than mental pictures of them, but viewed from viewpoints of nature and natural sciences, i.e. as mental pictures anyway) could be formally set according to their size as follows:

MACRO / MEGA / SUPERIOR / SENIOR / VERY BIG etc., systems such as the Universe, the biggest system known to humans, the Milky Way, the Solar System, the Planet Earth System etc., and

MICRO / INFERIOR / JUNIOR / SUB etc. systems that are smaller and are either natural such as Homo Sapiens / plant / animal / living creature/s, and or artificial / human-made systems such as a township / car / aircraft / rocket, etc.

⁷ As brief presentations in English see e.g. Dyck, Mulej (1998); Ecimovic, Mulej, Mayur (2002), Mulej, Zenko (2004a).



Of course, the above artificial and natural systems cause a need for differentiation of sciences to natural, technical and social sciences, of which none includes all human activities as an integral part of the nature. We think there are no artificial and natural systems, but all of them are natural as long as they are results of living creatures' activity. But we know it may take a long time for many to understand such a philosophy. For the time being, let us use, the terms artificial and natural systems.

We humans, with all our knowledge, beliefs, religions, natural, social and technical achievements, technologies, techniques, governances, local communities, families and relationships, sooner or later think we are Gods, which have to rule the nature, space and environment of the biosphere. When it comes to the point of joint action, "mutual interest" and survival of our civilization, many excuses are handy such as national interest / national security / national citizens' wellbeing, etc. But all of them are empty phrases defending/protecting individual/collective rulers, and national elites. We believe into the role of leadership, but we believe also into the moderate life style, which allows long life, peace, and stability, because Nature requires it.

So here we are – we have the Universe, the Milky Way, the Solar System, the Planet Earth System, and the life on the surface of its terrestrial and aquatic part as well as within its atmosphere. With the existing input/output effects from superior systems, especially the Solar System, with evolved parts of the Earth system, etc., our social system has an important evolvement to undertake. Corporate social responsibility, which is among late entries, and science have great role for survival of our civilization.

Information theory of nature and the corporate social responsibility

The corporate social responsibility directing e.g. the funds for research, allows for selection of targets for research. Of course corporation will direct funds for research according to their needs, and when we add targeted research on armament and war needs, we are somewhere at over 90 % of present research. That is where we are, and why we are at such a present reality. Many researchers (Einstein, Mayur) have pointed out the wrong distribution of research, towards narrowly specialized targets, but the funds are the deciding factor. Financially strong countries (G 7) will always sponsor funds for research of human killing devices (nuclear and like explosive devices, better and better guns and larger armaments, etc.), and hardly will find funds for research on side effects of them, and of synthetic chemical products released in environment and possible impacts/interference with nature chemicals, etc. All will agree it is dangerous, but not as much as to finance research. With corporations it is even more difficult: they would hardly finance "not essential" research, which is out of their range of interest. But the present status of biosphere is asking for a requisitely holistic research of effects and impacts of our up-to-date civilization research and practice.



Corporate social responsibility disappears, when corporation in co-operation with bureaucracy and government or political support have open hands for action as it is, and governments together with politicians are cutting a cake according to their abilities and interests. Altogether, today research is not in service of science, but of politicians, bureaucrats and managers plus stockholders rather than all stakeholders. There are many cases to prove this from CFC's (depletion of ozone layer), PCB's (possible change of genetic structure), nuclear technologies (which should stay in laboratories and not be used for killing), and of course climate change system (which has enough power to make this Earth biosphere inhabitable for humans), which together are supporting this statement.

The research should have possibility to manage itself and to serve humanity. We are opting for independent research and researchers who may contribute significant part of needed evolvement of our environment. Research and education are two hands of humanity, which not need to be one as it is now.

More about information theory and real nature you may find in our forthcoming book "The Information Theory of Nature".

Some final remarks

As a summary we would like to point out the need for restructuring of the present system of education and science, which in any case could not be depend of bureaucracy, politicians and the present status of governmental support. Education and science should have much more independence to allow for a requisitely holistic education system and make it based science system – stream 5.

No restructuring of education and science – no humane humanity and no survival of the Earth nature including humanity!

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NEW CHALLENGES FOR CHILDREN HEALTH IN INFORMATION ERA

The presentation is written by Dr. Timi Ecimovic, for the Children Summit in Montreal, Canada 22nd and 23rd October 2004.

INFORMATION ERA is wrongly named time in which we are living. Majority of the world population of today is using above mentioned term, without knowing what it is. Secondly the children are taking it as toy of choice. Finally, but not in real terms, the information era time is bringing new challenges for whole civilisation, and specifically to the children, who are essence of our existence. Let us discuss some of issues important to the children health as well as to all of us.

Nuclear technologies hazard – in my opinion the nuclear technologies should never get out of laboratory facilities. With use of nuclear technologies for any purpose, we have increased risk to all humanity as well as for the children.



The climate change system – triggering the climate change system to unstable status we have opened new era. The climate change system of the Earth nature itself has enough power to change our world into inhabitable for us one.

The synthetic chemical production, with unknown number of synthetic chemical products, is man-made part of the Nature, which we may consider as direct health hazard to us and our children.

The natural resources integrated mismanagement is coming to the point of total destruction. Lands are intoxicated by synthetic chemical products of pesticides, synthetic chemical fertilizers, plastic materials, and by products from landfills, industry, mega cities, land/water/air transport and etc. Also by now the ocean/seas waters are more and more polluted, and finally the air is coming to be of questionable quality. I was seating in my small boat in front of Slovenian coast (Adriatic Sea a part of Mediterranean Sea) before sun down in summer. It was strange experience. The sundown was not into the end of horizon but into the smog. I have realized, that our children have no chance to see proper sundown, due to our own interference with nature, pumping millions and millions tonnes of our by-products into atmosphere.

Let us go back into the matter of our gathering. I would like to open discussion on health risk to our civilisation originated from ourselves. What I would like to discuss, is the synthetic chemical products impact to the Earth nature, and consequences to our children. It has to do something with population natural and other issues, and health not from single unit perspectives but from single unit and the population as whole.

First I think we have to consider that the children are only way of survival of human kind. That is why; I am discussing the thinking on synthetic chemical products impact to our population and our children.

As case study I am offering the case of PCB's - Poly Chlorinate Biphenyl – any of a group of chlorinated isomers of biphenyl used in the form of a colourless, odourless, viscous liquid in various industrial processes and discharged in industrial wastes as pollutant (Webster's). During 60's of nineteenth century PCB's were invented as most stabile synthetic chemical product – mineral oil. PCB's were used for many purposes: all heavy machines construction or war, transformers and many other uses even as filler for wall paints (in USA), and estimates have stand that 6 million tons of PCB's were produced worldwide till 1980. The research in 60's of twentieth century has find the second face of PCB's, which showed that PCB's are not harmless but are affecting genetic structure of living beings. Also by analytical reports of fat content of PCB's in living creatures was proved distribution of PCB's all over the Earth, from polar bears to all other regions of the Earth.

In my opinion the synthetic chemical products, being produced by our civilisation, and put into use worldwide (pesticides, synthetic chemical fertilizers, pharmaceutical products, plastic's, paint's, cleaning and washing products, drink's, packing materials, armaments, transport equipment's, glue's, etc.) are pumping into the nature unknown agents, which may together with nature one's make unknown number of new products with unknown impact effects.

I think it is necessary to introduce overall control of such action to achieve better protection of human kind and children as only richness of our civilisation. Protection of our children from dangerous impact of synthetic chemical products could be helped with introduction of The Children Health Watch as institution of the United Nations.

Due to philosophical/world thinker's character of this gathering, I am offering the poem written by late president of World Vegetarian Association Prof. E. Just (+ 1990) - "Creation in reverse by sinful man" as thinking content. I would like to state in this case "not to happen, what the poem is talking about".



In the morning my grandchild woke, and sunshine in Mediterranean was there bright and warm, and he was happy another day.

Timi Ecimovic